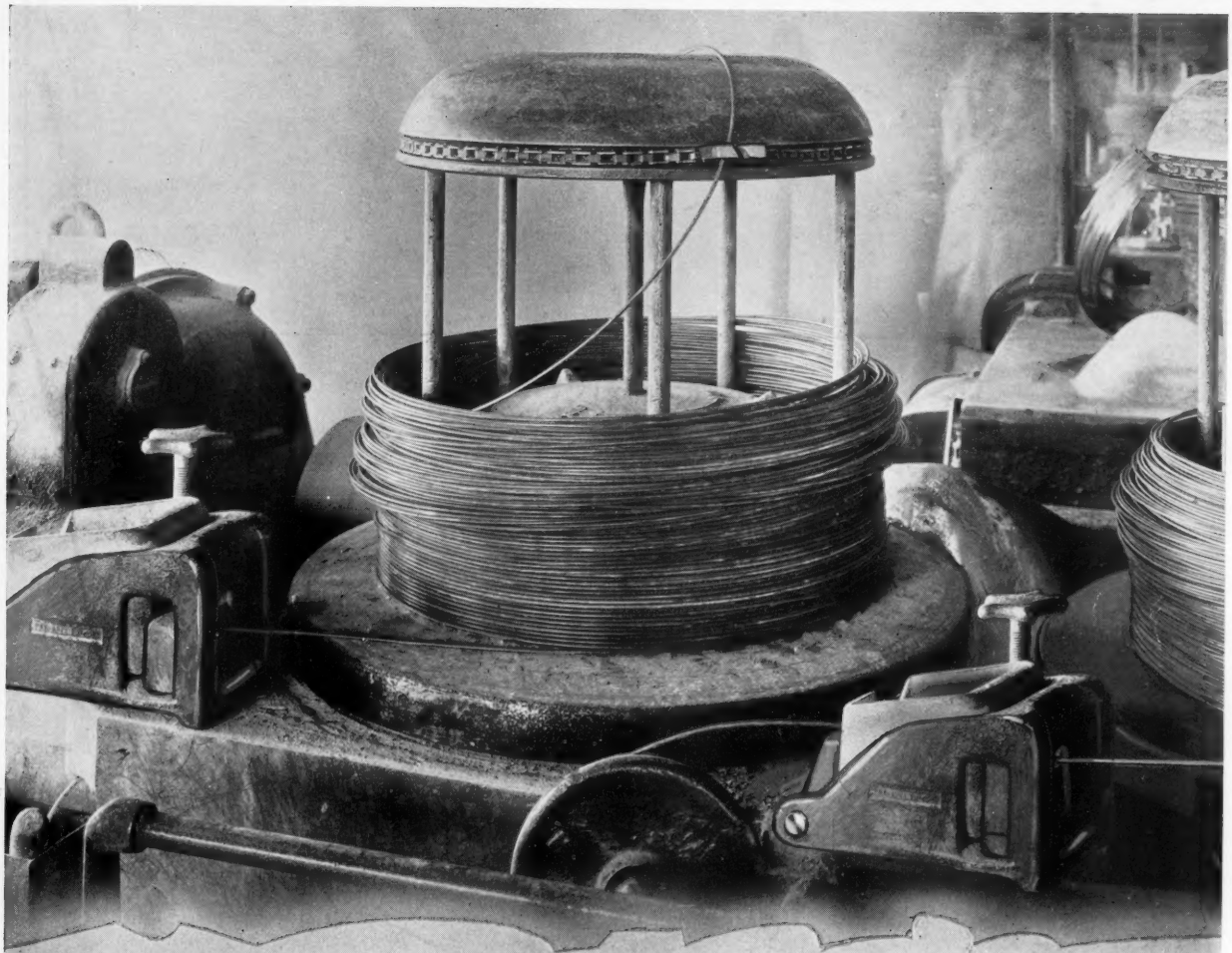
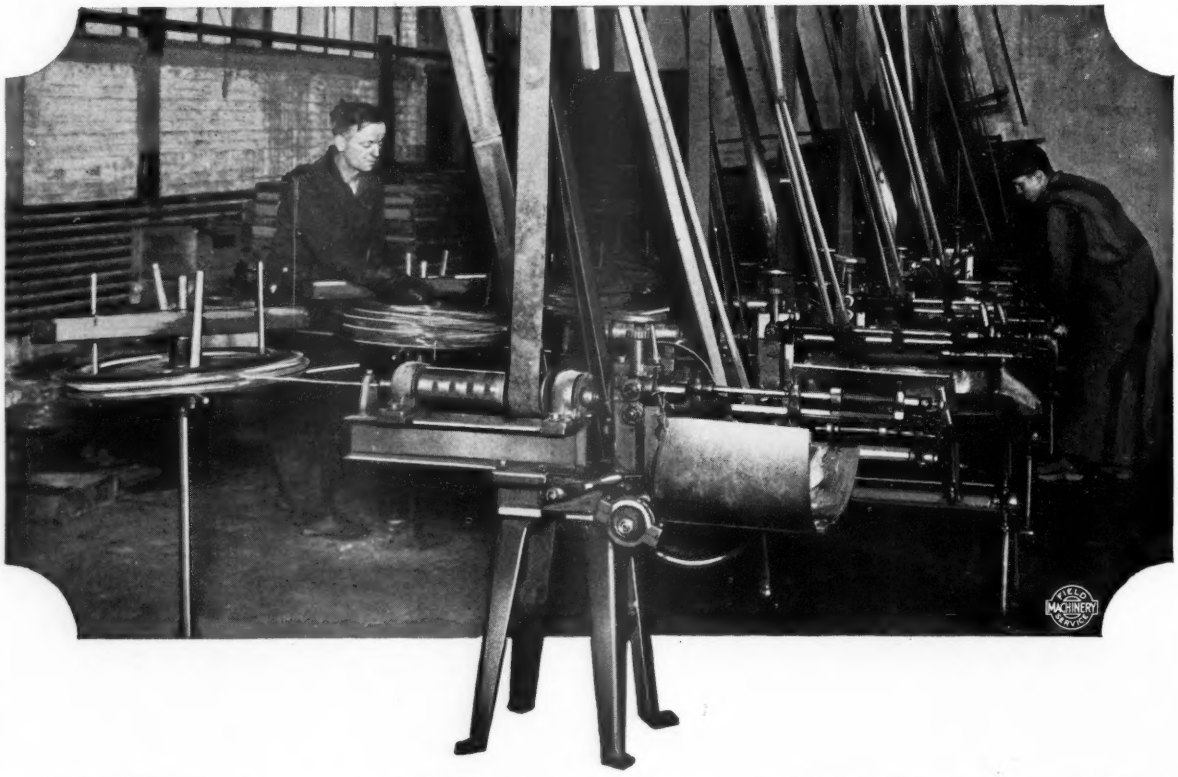
WIRE
& WIRE PRODUCTS



Morgan Connor Wire Machines
Greatly increase output per man in sizes between #10 and #20 gauge
Morgan Construction Co.
Worcester, Mass., U.S.A.

October 1927

Cutting Welding Wire



THIS photograph shows a battery of SEVEN SHUSTER AUTOMATIC WIRE STRAIGHTENING AND CUTTING MACHINES kept in CONSTANT SERVICE cutting welding wire for one of the largest concerns in this line

Six of these cut wire from 3/16" to 3/32" diameter and the seventh handles 3/8" diameter maximum down to 3/16". The wire varies from hard brass and cold drawn steel to aluminum and Monel Metal.

One machine was purchased first and the others have been added, as the need arose; they make money for this concern, and will for others.

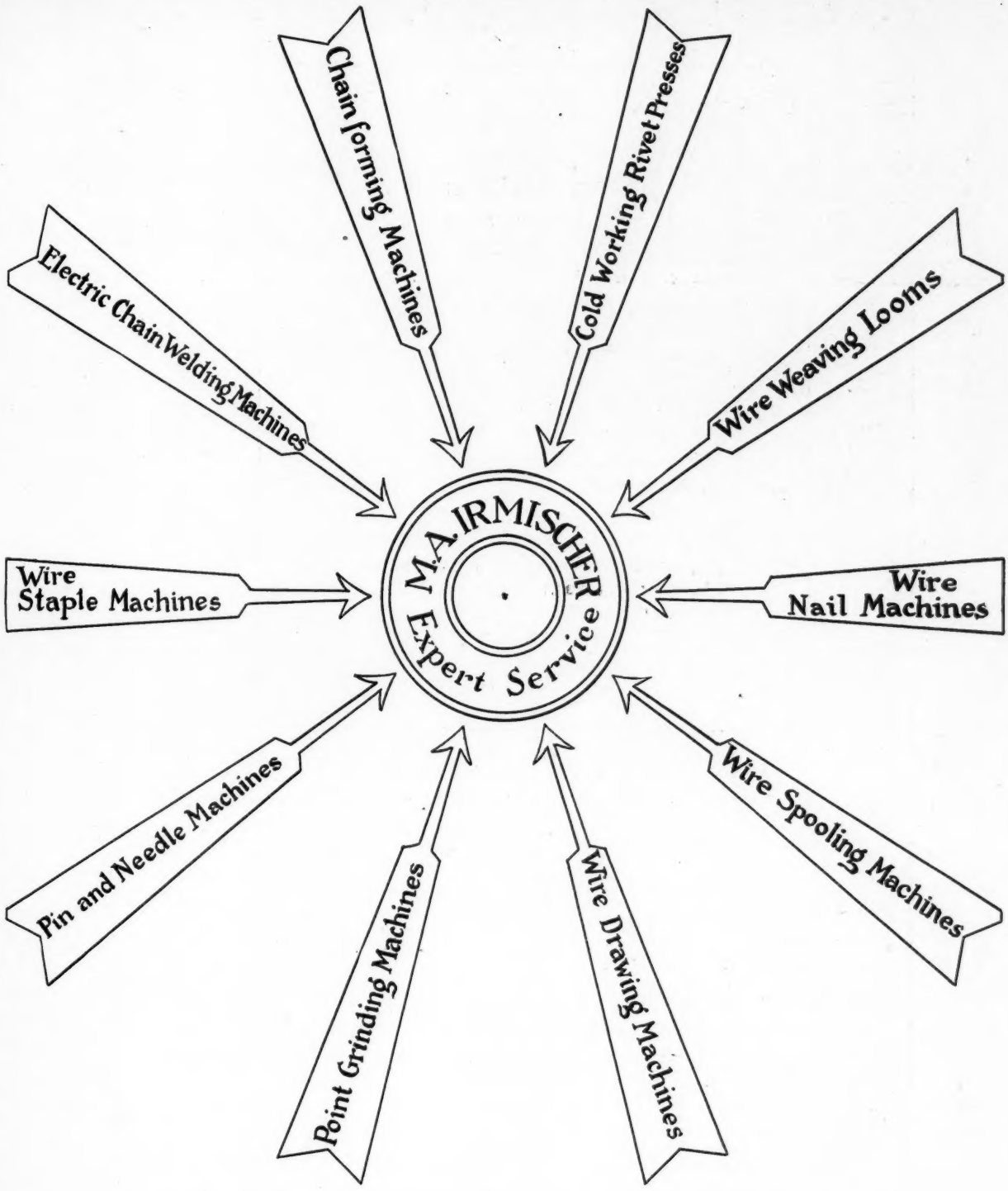
They handle all kinds and sizes of wire, making it perfectly straight, and cutting absolutely accurate lengths.

Tell us your needs, and let us recommend a suitable equipment for handling them.

The F. B. Shuster Co. New Haven, Conn.

STRAIGHTENER SPECIALISTS SINCE 1866

WIRE & WIRE PRODUCTS. Vol. 2, No. 10 October, 1927. Publication office, 49 East Washington Avenue, Washington, N. J. Executive office, 471 Fourth Avenue, New York, N. Y., by the Hoffman Publications, Inc., Sylvan Hoffman, President. Subscription price, Domestic, $5.00 per year, 50 cents per copy; Foreign and Canada, $7.50 per year. Entered as second class mail at the Post Office at Washington, N. J., under the Acts of March, 1879, and copyright, 1926, by The Hoffman Publications, Inc.



M. A. IRMISCHER

48 East 41st Street, New York City

SOLE AGENT IN THE U. S. A. AND CANADA FOR

Malmedie & Co., A. G. Dusseldorf — **Franz Irmischer, Saalfeld**
F. W. Buendgens, Aachen — **Lorbeer & Schwenk, Saalfeld**

TEL. MAIN 1287

THIS LETTER ARRIVED THIS MORNING

MERCHANDISE CO.
DISTRIBUTORS
JOBBERS

ROCHESTER, N. J.

Wire and Wire Products,
471 Fourth Ave.,
New York City, N. Y.
Gentlemen:-

We are enclosing herewith a piece of stainless wire.

We would appreciate it if you will kindly let us have a list of the manufacturers who make machines for the pointing of wires. We desire to use a machine of this kind in making Ice Picks from straight wire.

Yours truly,

After December 15 Letters of This Type Will Come to you Direct.

That Is

If You Take This Opportunity to Order at Once Advertising Space in the New

WIRE & WIRE PRODUCTS
DIRECTORY, INDEX AND BUYERS GUIDE

WIRE FOR ADVERTISING RATES

MORGAN
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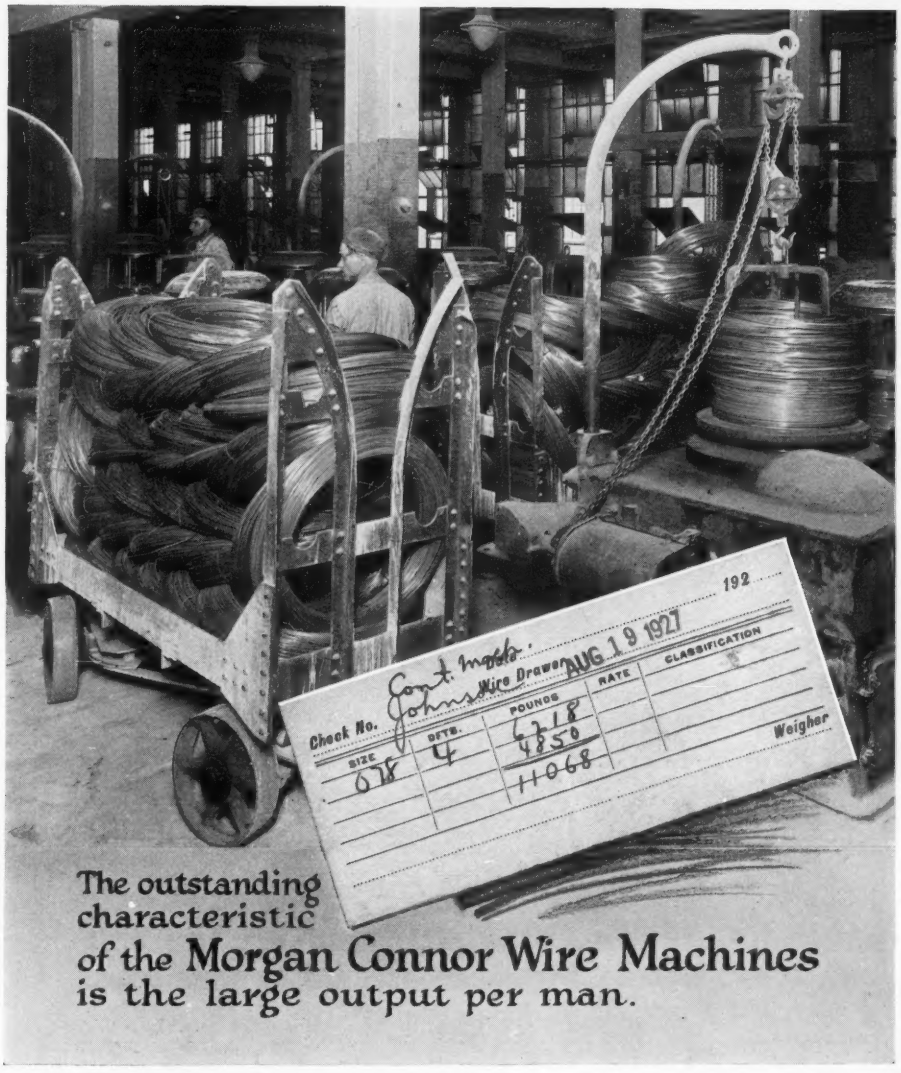
ENGINEERS AND MANUFACTURERS



The outstanding characteristic of the Morgan Connor Wire Machines is the large output per man.

MORGAN CONSTRUCTION CO.
WORCESTER, MASSACHUSETTS, U.S.A.

BRANCHES - NEW YORK CLEVELAND

NIELSEN CERTIFIED PERFORMANCE SURVEYS

TELEPHONE RANDOLPH 6526

A·C·NIELSEN COMPANY

111 West Monroe Street
Chicago

September 21, 1927

Wire & Wire Products
461 Fourth Avenue
New York, New York

Gentlemen:

We have, as requested, examined the statements prepared by Morgan Construction Company and described by them as extracts from Nielsen Surveys of Morgan-Connor wire machine installations.

A 4-page draft of these quotations is being sent to you herewith. We have checked back to our engineers' reports and find the extracts correctly quoted and correctly referenced as to survey number. All statements in the submitted copy, except-ing only the explanatory parentheses, were made by Nielsen engineers in reporting the results of their studies of Morgan-Connor installations.

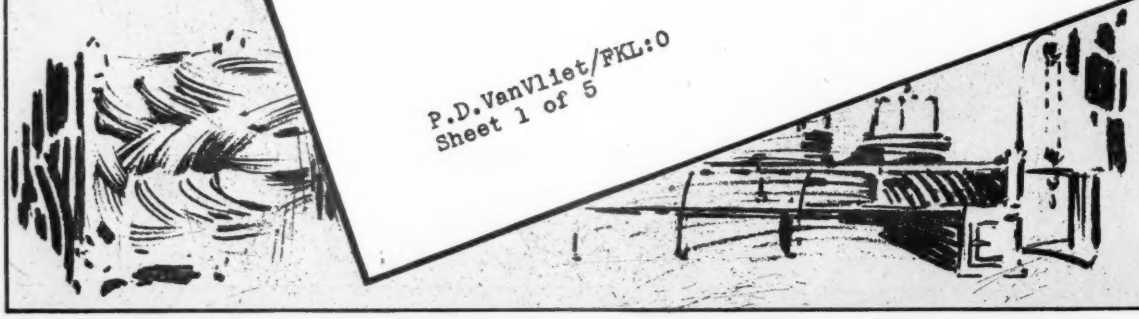
The statements and calculations have, in every case, been checked and O.K.'d in writing by responsible executives of the various wire mills. The Morgan Construction Company in publishing this matter and in describing it as definite, reliable and unbiased performance data upon which the selection of materials and equipment may safely be based.

Very truly yours,

A. C. NIELSEN COMPANY

P. D. VanVliet
Chief Engineer

P.D.VanVliet/FKL:O
Sheet 1 of 5



Reliable and unbiased performance data

SURVEY No. MC-10-HM
(#5 Rod 4 drafts to 14)

Repairs on the machines have been almost negligible.

Only 0.1% of the wire is in less than full length bundles.

Amount of scrap.....is estimated to be less than..... 0.3 pounds per 1,000 pounds wire produced.

Quality of the product has been improved....A check of 20 bundles selected at random....showed a maximum variation from gauge of only .0007 inches.

Safety is greater with the semi-continuous machine....If the entire group of Morgan-Connor machines is taken....the lost time due to accidents is.....6.82 shifts per 100,000 hours.... while that for the wire mill as a whole is 28.03 for the first five months of 1927.

Savings affected are, per 1,000 pounds, $.5673.

Net annual return on investment is 31%.

SURVEY No. MC-25-UZ

An experienced operator can thread the machine in three minutes, actual observed time, not including the running time required to get....surplus turns on the drums.

The following tabulation will indicate the production rates per man....The averages are based on the records of several operators and cover a number of turns in each case during which the production was confined to a single size of wire only.

Wire Size	Production per man per turn
#13	12,916 lbs.
#13½	11,202 "

The production per man per turn has increased as previously mentioned from 6214 pounds to 12,778 pounds. The gain is...105%.

The quality of the wire produced on Morgan-Connor machines compares favorably with that produced by the single-block method. There is no appreciable difference in spoilage and the scrap from both types of equipment in the last three months has totalled only .09% of the total production.

Labor rate is 20% less.

Men are at present....earning 64% more....than....on the single-block machines. (This survey compares Morgan-Connor machines with direct motor driven single-block units.)

SURVEY No. MC-11-HM
(#5 Rod 5 drafts to 15 & 16)

Floor space reduction is 35.2%.

Breakage is also much less giving more full weight bundles.

Handling of production with the Morgan-Connor machines is simpler....Finished wire and rods are separated and there is no storage of partly completed wire....Cost keeping is also simpler.

In a full year at the rate of production carried on in the three months studied, the total saving is $7,103.22 (2 machines). This is a net return of 48% on the investment in Morgan-Connor machines and auxiliary equipment.

SURVEY No. MC-16-AZ
(80% Carbon Patented #9, 4 drafts to #15)

The first two units were installed in 1924 and four others have since been added. Results have been satisfactory in all respects.

....it has been possible to reduce wire drawing labor costs by 35.5%, to save 58% in floor space and to so improve the quality of product that scrap is reduced to an unrecorded and negligible item.

The operators are unskilled men who were easily taught to run Morgan-Connor machines without previous experience in wire drawing.

The labor and floor space savings are ample to justify the installation of Morgan-Connor machines from the economic standpoint alone but they are by no means a complete indication of the benefits derived.

SURVEY No. MC-13-HM
(12½ Annealed 5 drafts to 20)

In a year of operation, these machines have clearly indicated their ability to produce a high grade of wire with less scrap and at substantially less cost than the single-block wire drawing equipment which they replaced.

Quality of wire has been improved.

Breakage is so small that no record is kept of it.

Scrap amounts to less than 0.6 pounds per thousand pounds of good wire made.

Floor space reduction is 54%.

Saving affected per 1,000 pounds #20 wire is $2.9106.

Reduction in cost is 36%.

Net annual return on investment is 61.4%.

SURVEY No. MC-20-KZ
(#5 Gauge 4 drafts to #13)

The operation of the semi-continuous drawing machines shows a net annual saving in drawing cost as compared to the 10-block rod frame even though the new machines are operating at a disadvantage because of the fact that one class of stock cannot be kept running through them continuously. (Basic and Bessemer stocks are drawn alternately.)

Complete surveys from which the above statements are quoted are on file and in most cases are available on application to the Morgan Construction Company

Morgan Connor Machines

are in service in 26 Plants

229 Blocks are on repeat orders

WIRE & WIRE PRODUCTS

A monthly publication devoted to wire drawing and wire forming

Vol. 2 October, 1927 No. 10

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Editorial Offices:
471 Fourth Ave., New York City, Tel. Ashland 6280
Publication Office, Washington, N. J.
Issued Monthly **Subscription Price U. S. $5.00**
50c a Copy **Foreign $7.50 per year**

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Rotary Wire Straightening And Cutting Machines

FULL AUTOMATIC

Equipped with flying shear allowing uninterrupted feed of wire through the machine.

Guaranteed not to mark or swell wire in spots.

Write for Bulletin

HALLDEN MACHINE CO.

Thomaston, Conn.

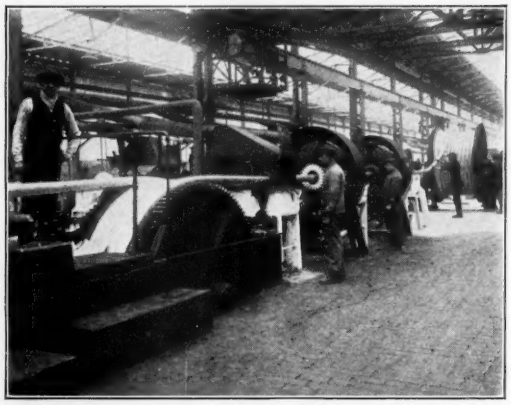
WIRE
& WIRE PRODUCTS

Vol. 2 OCTOBER, 1927 No. 10

A Tour of the British Insulated Wire Company's Works

A forty acre plant in England

By A. C. Blackall



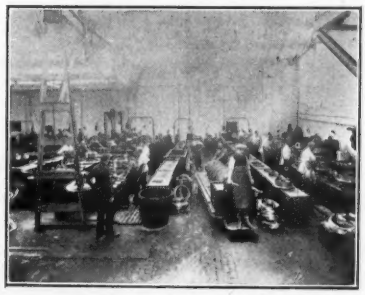
Armoring machine with a 33,000 volt cable, at the Prescot works, British Insulated Wire Company.

THE pioneers of the manufacture of paper insulated cables in the United Kingdom were the British Insulated Wire Company, which commenced operations at Prescot, Lancashire, in 1891. Eleven years later this company amalgamated with the Telegraph Manufacturing Company of Helsby, Cheshire, and this amagamation formed British Insulated & Helsby Cables, Ltd., which was later abbreviated to British Insulated Cables, Ltd. Under the last name the company has become the most important electrical manufacturing concern in the world.

Every process in the making of cables is carried out in the company's huge works at Prescot. In the space of 37 years the area of the works has grown from 2 acres to 40, an average growth of over an acre per year. Such growth implies a vigorous organization and a far-sighted merchandizing policy. When the founders of the undertaking first put paper cables on the market they can have had but a dim idea of the vast field which has since opened up in the direction of power transmission. Today the works can turn out something like 100 tons of copper conductors per day and over 100 miles of finished cable per week.

Since 1920 large extensions have been added to the works, including a new copper refinery, new rolling mill, heavy wire drawing plant, and a new cable shop, which is a factory in itself. These developments have been rendered essential by the huge demand for the firm's cables from all parts of the world.

The works are favorably located, with the main Liverpool to Warrington road bordering them on the north side and the extensive sidings of the London, Midland & Scottish Railway on the east. A double track connects these sidings and the works, running through a cen-



Part of the heavy wire drawing shop.

Extruding department. Rod after extrusion is drawn on heavy wire drawing machines in foreground.

tral avenue of loading and unloading yards and sheds from which the various departments radiate. The principal manufactures of the works are, of course, copper wire and rod, etc., and paper insulated cables of every description. The accessories branch, however, is by no means a small one, covering an area of about 14 acres; cable boxes, pillars, switches, fuses, electric meters and bonds are but a few of the products.

In a tour of the works, which is a much bigger task than it sounds, the first place of interest, taking the cable-making departments in the order of manufacturing process, is, curiously enough, also the last, being the copper refinery, where the scrap metal collected from the various departments is also dealt with. The copper is melted down in oil furnaces and moulded into billets about 3 feet long by 3½ inches square. The first process in the treatment of the billets or "wirebars" is the heating in reverberatory furnaces, which is followed by rolling while red hot, together with bulk supplies from outside sources, into wire rods about ¼-inch diameter. This rolling is done through three trains of rolls — roughing, intermediate and finishing. Twenty-one passes are requisite—eleven through the roughing rolls, three through the intermediate and seven through the finishing. There are four rolling mills, two being used for copper rod rolling the the others for aluminum rod and sheets. Each copper rod mill is equipped with a reheating furnace and three sets of rolls. After rolling, the copper rod carries a black oxide scale which is removed by immersion in weak acid. Before rolling, however, the hot rod is coiled. The de-oxidizing is done in long pickling tanks.

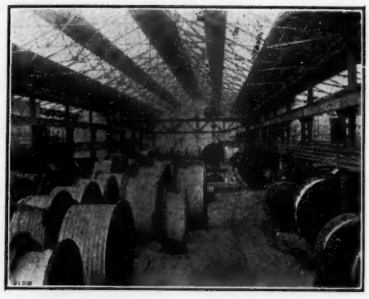
The next process of importance is the wire-drawing, the bulk of which is effected in a new and well-equipped shop, 240 feet by 150 feet, but the very fine wires are dealt with in two smaller rooms after being reduced to about No. 16 gauge in the first mentioned shop. Two methods of drawing are carried out, on automatic and single block machines. Wires for special uses are dealt with in the latter. The rod is first reduced through nine dies to No. 16 gauge and then through a further ten dies to No. 25 gauge. These dies are of chilled cast iron and are made on the premises. From No. 25 gauge the wire is drawn on the fine wire drawing machines through sixteen or more diamond dies to reduce it, if required, to the smallest size, one thousandth of an inch diameter. Single block machines are used for special sections, trolley wires and all heavy gauges. In the final stage of drawing the wires are hard. For the process of cable-making it is necessary to anneal the wires and this is carried out in Bates & Peard bright annealing furnaces. In the chambers of these furnaces is a steam pressure slightly above that of atmosphere. Each chamber is airtight, and the openings through which the wires enter and leave are water-sealed. Most of the machines in the wire mill are driven singly by electric motors, 4,100 horsepower of which are installed in the rolling and wire mills.

The extruding department is of particular interest and importance. Here the metal, instead of being rolled, is extruded through dies in a plastic condition. In the accompanying photograph of this department two

Bright annealing plant of the British Insulated Wire Co.

trolley wire drawing machines are shown in the foreground, and it is on these that grooved contact wire for traction work is drawn, forged steel dies being used. Much heavier work, such as bus-bars, etc., is dealt with on draw benches, on which the bars, etc., are drawn down to finished size after extrusion. Some American metal presses, which are used for the extrusion process, were installed for munition-making purposes during the war. Aluminum sections, angle-channels, beading, etc., are also products of the extruding department, which is served by a 5-ton Heywood crane.

It is interesting to note that



Test room.

the output of copper exceeds 100 tons per day. All the wire for the undertaking's rubber-covered cable works at Helsby, Lancashire, is manufactured at the Prescot works. This wire, in order to prevent action on the copper by the sulphur in the rubber, is tinned by passing it through baths of flux and molten metal. To comply with the standard specifications of the British Engineering Standards Association, all hard-drawn wires are subjected to the usual wrap and twist tests in the shops, and tests for elongation, conductivity, etc., are carried out in a fully-equipped testing laboratory.

It is necessary in many cases to produce longer lengths of wire than are turned out by the machines, and to meet these requirements electrical butt welding machines, of the firm's own design and make, are installed in the wire-drawing shops.

The extensive rooms of the wire-stranding department make the next call on the metal. Stranding machines for all sizes of cable are installed, including those of the rotating bobbin type, and others of more modern design in which the bobbins float in line with the cable.

The stranded cores are now dealt with in the paper-covering rooms. Here the paper, which is received in rolls 24 inches wide, is cut into strips of about one inch in width, and wound on reels on paper-cutting machines, each machine dealing with a complete roll in one operation. The wound reels are installed on the paper-covering machines, which transfer the paper to the cable cores. These machines are of the tandem type, and some of the larger machines wind 40 layers of paper in one operation. The paper used for insulation of the "outers" of concentric cables is impregnated before application—in all other cases the cores are covered with dry paper.

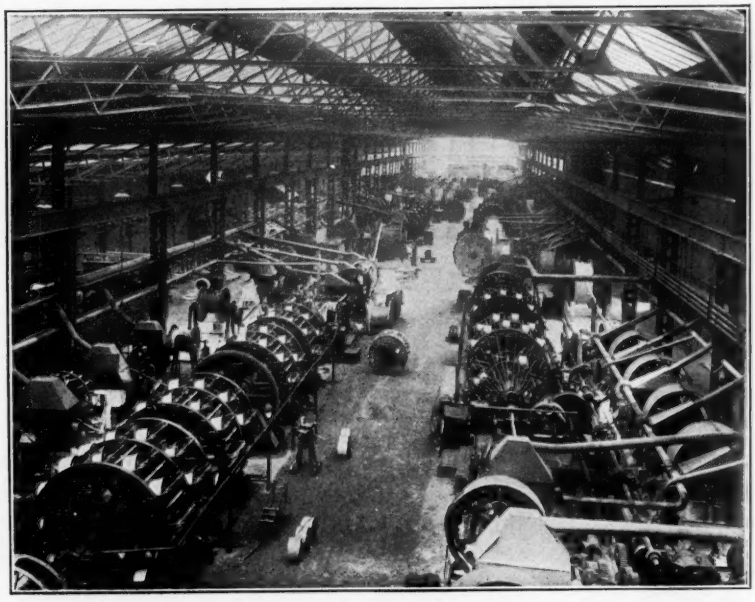
The cores for multi-core and twin cables are prepared separately, after which they are built up on very large covering machines which lay up the cores, run spun yarn into the spaces between them and apply the outer or overall insulation.

Samples of the paper received are analyzed in the chemical laboratory to insure that they

Braiding machines.

contain no matter which will prove injurious to the metal or to the paper itself in the course of time; also to ensure that it is of sufficient strength to run on the machinery. It is of importance that the paper should be able to withstand the temperature to which it is subjected in the drying ovens, where it is treated after being applied to the cable, and again in the process of impregnation. The paper must have a certain limit of porosity sufficient to allow the impregnating oils to penetrate, but not sufficient to allow them to flow away. It is interesting to note that one function of the paper is to hold the oil in thin layers, it being a peculiar property of oil that it is stronger electrically in films than in bulk. The main insulating room is served by two cranes of 15 and 5

(*Continued on page 363*)



Armoring shops at the Prescot works.

The Drawing of Round Wire

Wire drawing machines prevalent in British shops

By J. D. Brunton

Bruntons Research Lab., Musselburg, Scotland

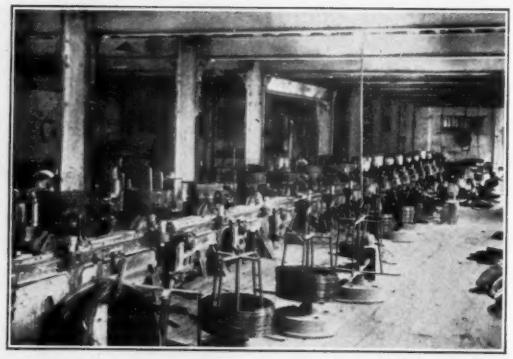


Fig. 2.—Portion of a wire drawing bench in a British shop.

THE term wiredrawing is doubtless somewhat misleading because it is apt to give one the impression that wire is made by stretching the rod by a direct pull. When a rod of metal is put into a tensile testing machine and a load applied to it, permanent stretching will occur only very locally at the weakest portion of the rod, the rod as a whole being stretched very little. If, however, we not only apply a direct pull but at the same time some lateral pressure to the rod, such pressure for example as may be applied by placing a round bar or mandril through a loop in the rod and rolling this mandril from end to end while the load is being applied—then stretching will take place more or less uniformly throughout the whole length of the rod, and it will be elongated to at least double its original length. In all probability some of the early specimens of wire were actually produced in this way before the invention of the die or drawplate.

The wiredrawer's die which is the essential tool in wiredrawing has an effect somewhat similar to the mandril in that it applies lateral pressure, causing the metal to yield locally at a very small portion of the rod at a time, each part of the rod receiving this lateral pressure in its turn as the rod is pulled through the die. Thus the flow or elongation of the metal is due to compression from the sides of the die and not by direct stretching, although, of course, the pressure of the die is caused indirectly by the pull on the reduced section of the wire. It is an elementary application of the resolution of forces, the direct pull being resolved into forces normal to the taper of the hole in the drawplate.

In its simplest form the actual drawing operation is carried out as follows: The coil of wire rod, which has been pointed and cleaned as described in the previous chapter, is placed on a swift or reel which revolves freely on a stationary vertical spindle. The pointed end of the rod is then thrust through the die, gripped at the other side by a pair of tongs and pulled through until there is sufficient length of the reduced wire to be attached to the drawing block or drum. This is then thrown into gear and in revolving pulls the remainder of the coil through the die.

The drawing of the metal bar through a die has the effect, not only of compressing and elongating the bar, but also serves the purpose of producing a smoothly finished product of much more accurate diameter than can be obtained by hot-rolling. Wiredrawing is also utilized to develop in the metal some desired physical characteristic which is due to cold work. When round material is required of a smaller diameter than 7/32 of an inch it is cheaper to produce it by wiredrawing than by rolling.

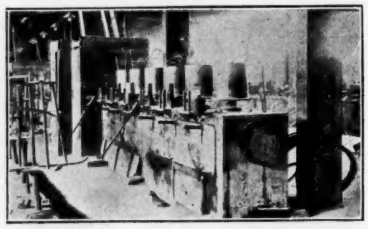


Fig. 3.—A bench of jigger blocks.

It will be readily appreciated that wiredrawing requires much more power for a given reduction in area than hot rolling, as the metal has to be reduced in

Table I—Analysis of Cast Steel Draw Plates

		1.	*2.*	*3.*	*4.*
Carbon	per cent	3.360	2.000	1.620	2.650
Graphite	" "	nil	nil	nil	nil
Silicon	" "	0.140	0.210	0.290	0.042
Maganese	" "	1.300	0.530	0.440	0.300
Sulphur	" "	0.031	0.029	0.028	trace
Phosporus	" "	0.050	0.034	0.031	0.022
Tungsten	" "	nil	nil	nil	nil
Chromium	" "	nil	0.150	2.210	14.270

area while cold. It, therefore, follows that any given size of wire should be produced from a rod which is hot rolled as close to the finished size as is practicable and the necessary requirements of the product will permit, depending upon the physical properties that are desired in the finished size.

In ordinary mild steel of which is produced the largest wire tonnage, the hot rolled rods as a rule arrive in continuous pieces varying from 100 to 300 lbs. In the higher grades of steel weights are less and when one is dealing with very high grade steel, such as high speed steel, it is not advisable to have rods heavier than 20 to 30 lbs. in weight.

Round wire up to ½" diameter is drawn on a vertical drum. Wire of a larger diameter than this is usually drawn on a horizontal drum, and there are mills now drawing wire up to 1" diameter in a coil. Above this point it is customary to draw wire in straight lengths on a bench.

These various mechanical devices will be explained later in this chapter.

Die or Draw Plate

The die used for drawing wire is of very great importance if round and smooth wire is to be

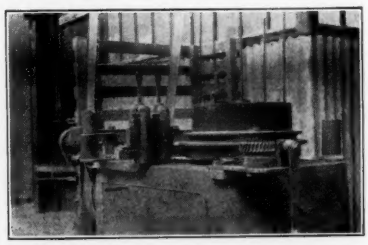


Fig. 4—A double block.

produced. In Canada and the United States the mills producing the thicker gauges of wire in soft qualities, such as are used for fencing, telegraph, nail wire, etc., use chilled iron dies. These dies are reamered out to the size and the wire is drawn through them. When the hole is enlarged through the passage of the wire they are then reamered to a larger size but, as can be readily understood, these dies can never be made to draw a smaller gauge of wire.

In Great Britain and the Continent chilled iron dies are not used and even in the States only the cheaper grades of wire are drawn through such dies. All high grade wire, such as high tensile or high carbon wire particularly in the finer sizes, is drawn through crucible cast steel dies.

The ordinary draw plate contains as a rule from 1.8 to 2.0 per cent carbon. Of late years chrome steel draw plates have come into use because chromium increases the resistance to abrasion.

In Table I are given typical analyses of four cast steel drawn plates used.

The draw plate is generally about 10" long, 5" wide, by 1½" to 2" thick, and has 18 holes pierced in it, all the holes being for the same size of wire.

The shank is used for holding the die while it is being manipulated, the steel being first hot punched in a tapering manner. The hot punching of this steel has the effect of putting a smooth skin of metal round about the punched hole; it is then worked up cold by battering on the side the wire leaves the die, and punching it on both sides by the cold punch until the surface is perfectly smooth. As a final test, what is known as a "set" piece is put through, this

Fig. 5.—A two-block wire drawing machine.

being a piece of hardened steel of the size required in the finished wire.

There are, of course, many other sizes of plates used, such as small rectangular plates containing a single row of six holes. These are usually called "jigger" plates, and are used for drawing wire on "jigger" blocks, i. e., small single holing machines for drawing wire from about 18 to 22 s. w. g.

In addition to this there are small rectangular plates containing one hole, and button dies containing one hole, the latter being used principally in continuous drawing machines.

For very fine wires diamond dies are frequently used. These dies have a small crystal of diamond set into a disc of metal, and a hole is worked through the diamond by means of special drills and diamond

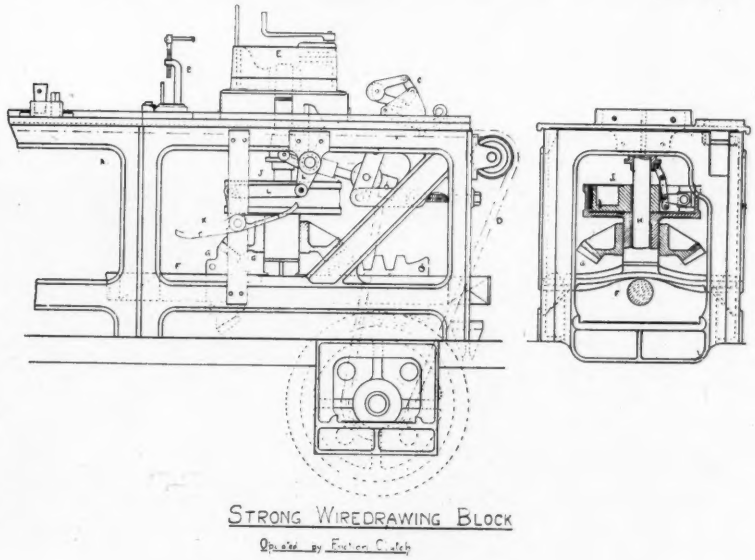


Fig. 1

dust. Special machines are built for polishing the hole in these diamond dies. If the hole is not kept with a very smooth surface it will scratch and scrape the wire.

In cast steel draw plates the hole enlarges a little after each piece of wire has been run through, and it is necessary to rebatter the plate and re-set the hole. This battering is done cold, then the wire-drawer's punch is inserted and the hole enlarged to the proper size. When this has been done several times, it is found that the plate will not batter up again. It is then heated in a muffler furnace and battered while hot, which has the effect of throwing some of the metal round about the hole, and so enabling the wire-drawer to use the die again for the same size of wire. It is most important for efficient working to see that all these draw plates are kept in the very best condition, otherwise the wire will not be round, or will scrape and form a ridge.

The actual taper of a die has a great deal to do with the production of satisfactory wire, and has to be varied according to the quality of wire produced.

If one is drawing soft material, i. e., annealed material which has a low elastic limit and a high percentage of elongation, the reduction must be sudden and the die must have a sharp taper, or to use the wire-drawer's phrasiology, the die must be "full."

As regards the reduction in area, this altogether depends upon the class of material to be drawn and the physical properties required in the finished product.

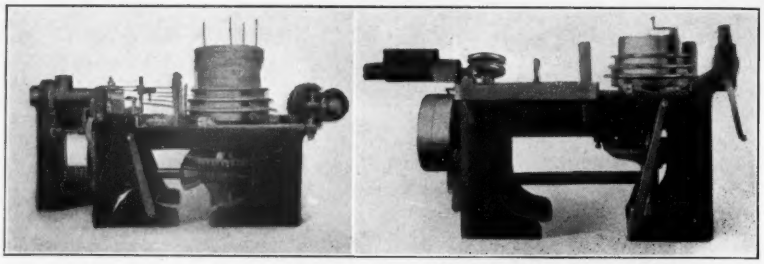


Fig. 6 and 7.—Differential blocks made by Barron and Crowther.

Wire-Drawing Machines

Vertical Spindle Machines

Essentially the wiredrawing machine consists of a steel drum mounted on a spindle which is geared to a main driving shaft. The drum or "block," as it is technically called, is slightly tapered from the bottom upwards, so that each lap of the coil of wire may slip out of the way and so allow room for the remaining laps as they come on to the block at the bottom flange and also to facilitate removal of the whole coil at the end of each operation. The coil forced upwards on the tapered block becomes slack and so gets into a smaller diameter and finally the bulk of the wire is bunched at the upper edge of the block or on extension pins rising above the ends ready to be lifted off and tied. There is generally also a small hand vise at the top of the block in which the point end of the coil is gripped before the machine is thrown into gear. In a small machine for drawing fine wire this vise is replaced by a small hole through which the end of the wire is threaded and twisted. Fine wire is then circled round the periphery of the block in a slanting direction until the bottom is reached, one or two laps being often coiled round the base so as to ease the tension on the point where the wire is fastened to the block and to obviate slipping when the load comes on. In drawing thick wire or rods the tongs which have to draw in the first few feet have to be actuated by a cam device, a capstan driven by the main shaft or a continuous chain running the length of the bench. As a rule, the length of wire pulled through in this way is

(*Continued on page 358*)

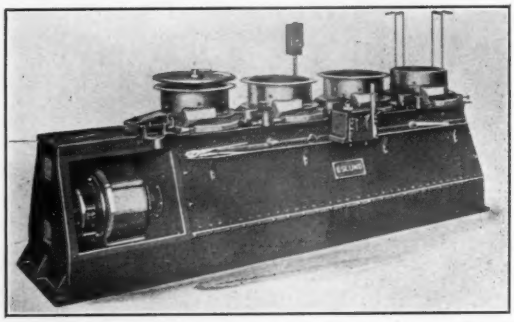


Fig. 8.— continuous wire drawing bench made by Oslund Mach. Co.

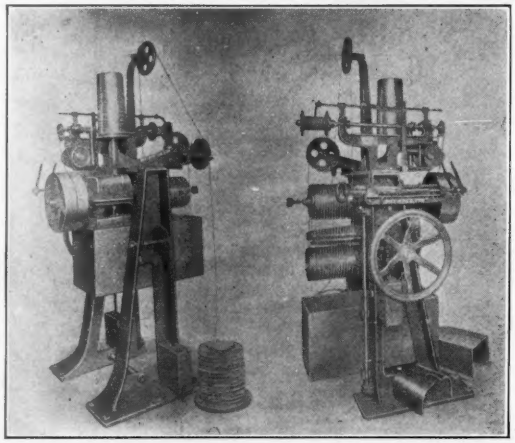


Fig. 9.—Continuous wire drawing machine for softer non-ferrous metals.

Transverse Testing Apparatus for Wires

By Herman A. Holz
New York City

ALFRED J. Amsler & Co., Schaffhouse, Switzerland, lately introduced the apparatus shown in Fig. 1 for making transverse tests of metal wires. The specimen rests on two end supports and is pressed downwards in the centre by means of a middle support. The transverse load is indicated by an index on a scale. When the specimen breaks, the index stops and shows the maximum load exerted. Moreover, the diagram of the transverse test is recorded on a sheet of paper. This diagram shows the corresponding values of transverse load and deflection. The distance between the end supports can be varied as required from about 2in. to 10in. (5cm. to 25cm.), the greatest thickness of wire that can be tested is about 3/8in. (10mm.), the maximum load 40lb. (20kg.), the largest displacement being about 2in. (5cm.).

Two columns are carried by a

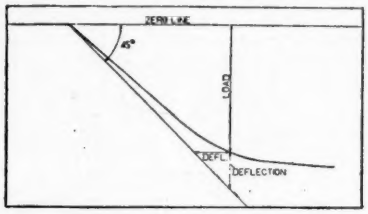


Fig 2.—Typical diagram obtained in transverse test of wire.

baseplate which stands on a small board on the worktable. It is not necessary to fix this board. A helical spring, used for measurement, is attached to the cross-piece which connects the two columns at their upper ends. The measuring spring carries a horizontal rail—the transverse beam—on which the end supports are fixed for taking in the test wire. The middle support, which pulls the wire downwards, is fixed to the upper end of a rack, which engages a pinion. The latter is rotated by means of a crank, so that the rack and the middle support can be pulled downwards. When the crank is being turned, the recording drum is, by means of bevel gear, rotated proportionally to the travel of the middle support. The recording pen is carried by the transverse beam, and moves downwards proportionally to the extension of the measuring spring and also to the transverse load. During the downward travel of the transverse beam a tube, with index, is pushed downwards on a scale on one of the columns of the frame, for reading the load in kg. and lb. and fractions thereof. The travel of the measuring spring is about 4in. (10cm.). A brake prevents the transverse beam flying back rapidly when the test wire breaks. The brake consists of two cords attached to the transverse beam, wound round two fixed rollers and loaded at their lower ends with a weight which slides along the columns of the frame. During the downwards travel of the transverse beam, the cords slide round the fixed rollers without pulling on the transverse beam. During the upward travel of the transverse beam the friction of the cord on the fixed rollers is, however, so great that the counter-weight cannot, or can only very slowly, follow. Before every new test, the weight is lifted by hand to bring the transverse beam to its initial position. The three transverse testing supports consist of small rollers each with a triangular groove, in which the test wire is centred. Each support rests between two cheeks, to prevent the wire flying off the apparatus towards the operator when it breaks.

The paper sheet for the diagram is placed on the recording

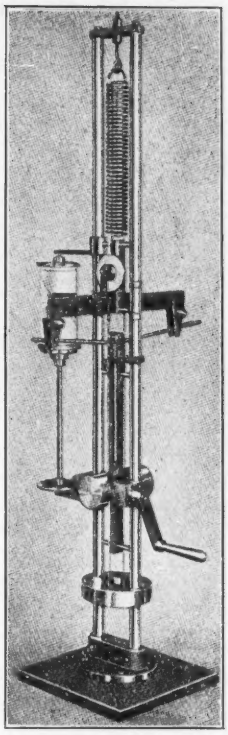


Fig 1.—Transverse testing apparatus for wires.

drum by means of a rail clamp. The diagrams are made by means of a pen filled with ink, not in rectangular but in oblique-angled co-ordinates. The diagram, however, is just as clear as if rectangular co-ordinates were used. A sample diagram is shown in Fig. 2. The horizontal zero line of the load is recorded by the pen by turning the recording drum on its axle by hand when the transverse beam is in its zero position. The oblique line below 45 degrees, starting from which the deflection is measured, would be recorded by the pen if the wire were not bent at all in testing. To determine the transverse load and the corresponding deflection for any point of the diagram, the distance is measured of this point, in a vertical direction, from the horizontal zero line of the load. This distance is proportional to the load. The distance of that point, in vertical or horizontal direction towards the oblique line, is equal to the deflection. The vertical distance of the point of diagram from the oblique line can also be measur-

(*Continued on page 369*)

Invention for Producing Wirebound Boxes May Be Used By Public, Court Holds

AS a result of hearing an infringement suit of Wirebounds Patent Co. and 4-One Box Machine Makers v. Saranac Automatic Machine Corporation, the District Court of Western District of Michigan held the public was entitled to the use of the inventions. The opinion of the Judge will be of interest to manufacturers and users of box wire.

The full text of the opinion by District Judge Raymond follows:

The three patents in suit relate to two machines and a method for producing wirebound boxes. These were issued February 9, 1915, to Inwood and Lavenberg and are No. 1128144 for "combined carriage and former for wirebound box machines," application filed October 14, 1904, referred to hereinafter as the workholder patent; No. 1128145, for "means for making box blanks," application filed October 27, 1904, referred to hereinafter as stapling machine patent, and No. 1128252, for "method of making boxes," application filed April 21, 1914, hereinafter referred to as the method patent; this patent being a division of the workholder patent.

An expired patent necessarily involved in this controversy resulted from invention substantially contemporaneous with the others and was issued upon a wirebound box which was the product of the above mentioned patents. This application was filed October 17, 1904, patent issued September 19, 1905, and reissued November 26, 1907, as No. 12725.

Plaintiffs Are Owners Of Patents in Suit

Plaintiffs are the owner and exclusive licensee, respectively, of the patents in suit. The defendant is the manufacturer and lessor or licensor of machinery for making wirebound boxes.

The history of the prior art briefly stated discloses that for a period of about 10 years prior to these inventions a series of inventors (known for convenience as the Rosback inventors) had endeavored to produce a box to replace the nailed box then in general use, the principal object being to combine strength, lightness, flexibility, possibility of use of cheap materials, and economical production. These efforts resulted in failure although it is evident that the conception was present that thin veneer and cleats might be coordinated with wire in some manner to produce the desired result.

The nearest approach to success was the use of a single sheet of selected veneer long enough to supply the four sides of the box assembled with cleat material of substantially the same length. Wire was stapled to this single veneer sheet, thereby producing a rigid blank which was pushed through a stepmitering machine which cut the cleat strips into four lengths, trimmed the two ends of the blanks and simultaneously stepmitered the respective cleat ends and lightly scored the long veneer sheet along the folding lines to facilitate bending.

This method produced a box which was light and strong but which lacked flexibility and elasticity. The substantial obstacles encountered, however, were the impossibility of automatic or partly automatic production and the checking and occasional breaking of the veneer sheets at or near the corners of the boxes.

Methods and Results Of Inventions Compared

The comparison of the method and results produced by the Rosback inventors and that of Inwood and Lavenberg is concisely stated in the specifications of the box patent as follows:

"The present method of manufacturing wire-bound boxes is to form the blank of a single sheet stitched or stapled to single piece cleats for each end of the box, the cleats being stepmitered and the sheets scored or grooved on the under side, so as to form four sections, after the cleats, sheets and reinforcing wires have been stapled together. This box blank when folded forms a rounding edge, the veneer sheets if not thoroughly seasoned so as to have pliability, begin to check as the lumber seasons. As the grain of the wood may be diagonal to the edge of the box, the check will follow the grain, thus rendering the box unsightly, besides a possible opening of a size so as to preclude its use for goods requiring a tight jointed box."

Plaintiffs Wired Separate Elements of Box Together

"Our invention relates to certain improvements in wirebound boxes, especially of that class in which the blanks constituting the four sides of the box are assembled and secured in relative position to each other prior to folding by reinforcing wires, and has for its object the assembling and fastening together such parts constituting the completed blank so that the same when folded will produce overlapping edges of the side sheets or boards, the advantages of which will be hereafter pointed out."

The underlying concept of the patents in suit is stated by plaintiffs to be the mechanical positioning of cleats and sheets in coordinated foldable relationships so that the immediate product of the machine shall be the foldable blank having relationships and coordination of

(*Continued on page 355*)

"The Manufacture of Insulated Cables in France" Part III

BY G. KESSLER

Will appear in the November issue of Wire & Wire Products

A Note on Welding Wire

By J. R. Leslie

SINCE a large part of a finished weld made by any of the modern processes of fusion welding represents added metal or metal from the welding rod, the nature of this added metal and the degree to which it merges with the parts to be joined, decide in large measure the success or failure of the weld. Just how much difference the rod itself makes in the speed of welding, strength and uniformity of results is interesting to note.

On a gas-welded steel pipe line recently completed in Southern California, it was found that a slightly lower grade of rod slowed down the progress of the welders by nearly 20 per cent. This represented a totally disproportionate increase in cost. As to reliability of the completed joints, 600 lb. hydrostatic pressure failed to produce a single leak in any of the joints made with the better quality rod.

If all welding rods were alike, there would be neither danger from the use of inferior or unsuitable material, nor the opportunity for users to profit through recognition of the differences which do exist. To illustrate: if two pieces of cast iron are welded by the oxy-acetylene process with a rod cut from one of the pieces, the resulting weld will lack the strength obtainable with rod designed especially for the purpose. When melted cast iron suffers oxidation and loses some portion of its original constituents. In its final form cast iron weld metal has a composition quite different from that of the rod. Hence the necessity for rods designed to give the right metal in the weld. Careful study of the changes taking place during fusion forms the working basis for the production of high grade rod. During manufacture the proper quantity of the more volatile element is added to compensate for the changes that accompany the welding operation.

The bulk of modern oxy-acetylene welding is done with five types of rod; namely, drawn or Norway iron, "high test" steel rod, cast iron, bronze and aluminum. The first of these (preferably copper coated to prevent rust), is used extensively for welding such materials as mild steel castings structural steel, steel plate and wrought iron and steel pipe—to mention but a few of its applications. Where still greater strength is desired, high test rod is meeting with great favor, since it works easily and produces joints with tensile strength a full 20 per cent higher than those obtainable with drawn iron rod.

Cast iron welding rod finds its chief application to gray iron castings, from small tools to large machine parts of every description. Where the problems of expansion and contraction become serious and preheating difficult, welding with bronze rod is proving exceptionally satisfactory. Lower welding temperatures and the soundness of the welds produced make the use of bronze particularly desirable for a rapidly increasing variety of work.

Good rod, of no matter what metal, should work smoothly under the flame, without much variation or noticeable sparking. Rods produced by well-known and unquestionably reliable equipment manufacturers cost a little more than those of uncertain origin. The difference represents insurance whose cost is ridiculously small in comparison with the value of the completed job.

British Wire Imports to Bear Mark of Origin

THE British Standing Committee appointed by Sir Philip Cunliffe-Lister, President of the Board of Trade, under the Merchandize Marks Act, to inquire into an application for an Order in Council that all imported wire netting and woven wire should bear an indication of origin at the time of sale or exposure for sale, has reported in favor of such marking.

The report, which the committee has just issued, states that the committee was impressed by the evidence given that in the absence of such marking there was a substantial possibility that a purchaser might not know when he was buying imported material, and, further, that in some cases he was liable to be seriously misled. At the inquiry no party appeared to oppose the measure and the committee therefore saw no reason to suppose that such an Order in Council would be harmful to the trade in wire and wire products. There is no doubt that it is practically possible to apply indication of origin effectively and without injury to rolls or bundles of wire netting or woven wire, and the committee did not consider that any prejudice would be caused to trade if the recommendations made were adopted.

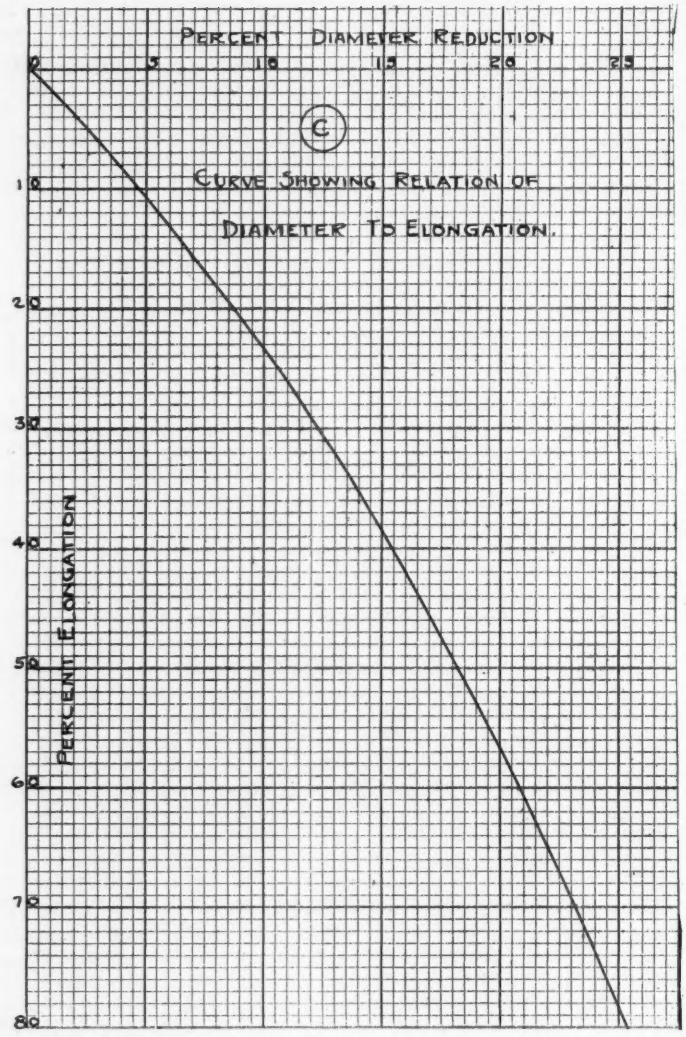
The committee suggested that the method of marking should be that "the roll or bundle shall bear conspicuously either on the outside or so as to be visible through the mesh, a label not less than eight inches in diameter bearing the indication of origin printed or indelibly stamped in a conspicuous manner in letters not less than one inch

(*Continued on page 354*)

Some Useful Charts for the Wire Drawer

By W. D. Pierson

Waterbury Farrel Foundry & Machine Co.



Curve C.—Showing percent elongation corresponding to any percent diameter reduction.

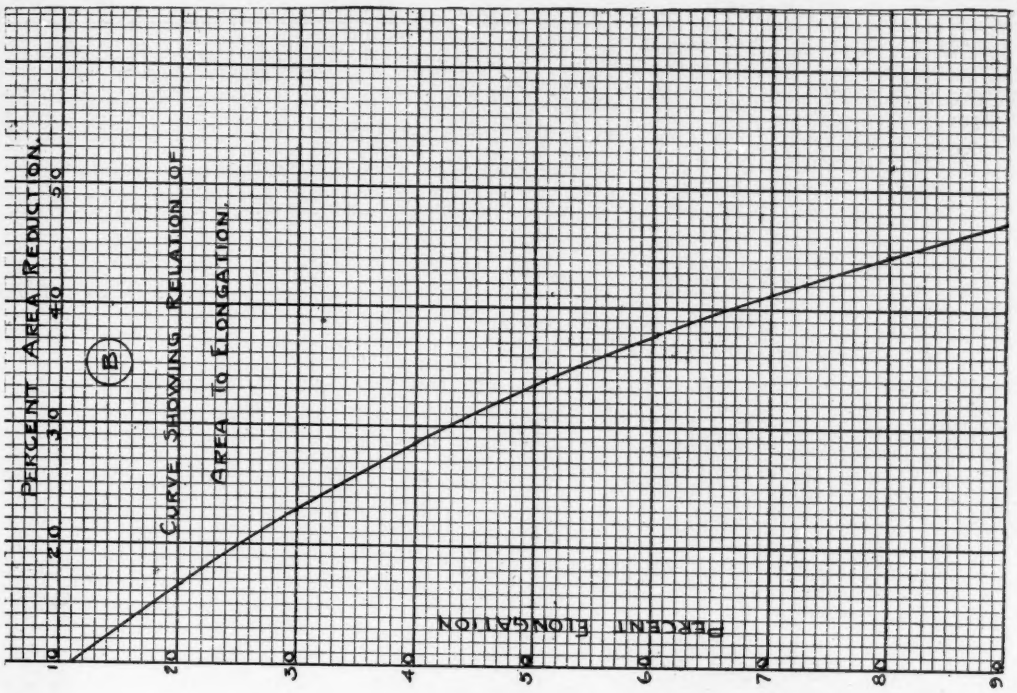
IN the operation of drawing wire and rod, the ratios of diameter reductions as compared with corresponding sectional area reductions and consequent elongations are of vital importance, and, while the numerical calulation is a comparatively simple matter, a quick means of deriving one from the other is desirable. The curves shown permit a direct reading to be obtained with sufficient accuracy for general use. As the diameter is the basic function and may be easily measured, this is assumed as the starting point. All readings are indicated in percentages.

Curve A Shows the relation between a percentage of diameter reduction and the corresponding percentage of sectional area reduction. Diameter readings are indicated at the top and area readings at left side. For example:— Assume a rod 1" diameter reduced to 7/8" diameter equals a 12½% diameter reduction-reading down from 12½% at the top to the curve intersection and then to the left gives approximately 23½% sectional area reduction. Similarly, a rod .40" diameter reduced to .30" diameter equals 25% diameter reduction giving approximately 44% sectional area reduction.

Curve B shows the relation between a percentage of sectional area reduction and the corresponding percentage increase in length or elongation. Area reductions are indicated at the top and elongations at the left side. Continuing the figures in Curve A, read 23½% area reduction at the top which gives approximately 31% elongation, that is, a rod 100′ long reduced 23½% in its cross sectional area would elongate to approximately 131′.

Curve C. shows a combination of Curves A & B giving readings direct from a percentage of diameter reduction to a percentage of elongation. This relation is the most frequently used in actual practice.

For convenience, assume the percentage followed in Curves A and B, that is, a rod 1" diameter reduced to 7/8" diameter equals 12½% diameter reduction which gives a corresponding elongation of 31%. Similarly, a rod .40" diameter, reduced to .30" diameter, equals 25% diameter reduction, will elongate approximately 78%. In other words, .40" diameter rod, 100′ long, becomes approximately 178′ long



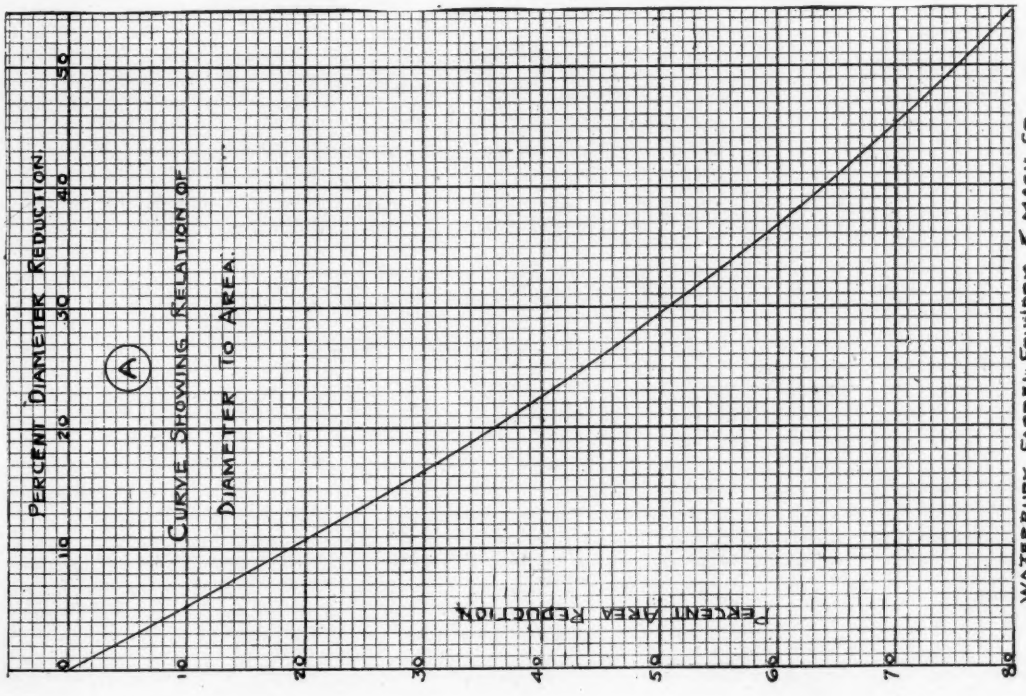
Curve B.—Showing the relation of percent area reduction to percent elongation.

when reduced to .30″ diameter.

It is interesting to note that the American or Brown & Sharpe Wire Gauge is the only gauge following a constant percentage of sequence between each successive number. The following are the ratios:

Any B. & S. size is 10.95% smaller in diameter than its preceeding size and 20.69% smaller in sectional area. This results in an elongation from one size to the next smaller of 26.09% increase in length. Convenient figures to remember are as follows:

One foot of any size B. &. S. Gauge when reduced one size will equal approximately 1.26′; when reduced two sizes will equal approximately 1.59′; when reduced three sizes, approximately 2.0′. In other words, three Brown & Sharpe successive reductions will double the length.



Curve A.—The graph gives the variation of percent area reduction with percent diameter reduction.

Sleeper & Hartley TRADE MARK

Practical Continuous Wire

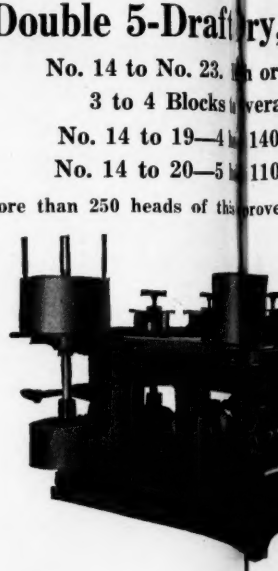
These Machines Go Into Production at One—

Rod Frame

(No. 5—14 or 15 wire)
Patented June 3, 1924—May 12, 1925—others pending
All Ball or Roller Bearings
No Differential Gearing.
Automatic Compensation for Speeds of Heads.

Double 5-Draft Dry

No. 14 to No. 23. [illegible] or
3 to 4 Blocks [illegible] vera
No. 14 to 19—4 [illegible] 140
No. 14 to 20—5 [illegible] 110
More than 250 heads of this [illegible]prove



WIRE MILL EQUIPMENT

TINNING AND GALVANIZING FRAMES AND WIPERS

PATENTING FURNACE TAKE-UPS

WIRE POINTERS. WIRE PULLERS

WIRE SPOOLING DEVICES

MULTI-HEAD WIRE STRAIGHTENING AND CUTTING MACHINES

WIRE TWISTING AND STRANDING MACHINES

AGENTS: CHICAGO TERRITORY,
Neff, Kohlbusch & Bissell, Inc.

SLEEPER & [illegible]

FOREIGN AGENTS AND REPRESENTATIVES: UNITED KINGDOM—Mr. Fredk. A. Perry, 63 Queen Victoria St., London. E. C. 4. FRANCE—Mr. Edgar Bloxham, 12 Rue du Delta, Paris. BELGIUM—Isbecque, Todd & Cie., 25-27 Boul. Emile Bockstael, Brussels.

WORCESTER [illegible]

Wire Drawing Machinery

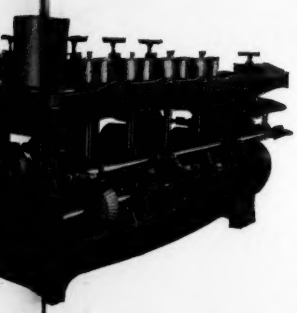
Sleeper & Hartley TRADEMARK

REG. U.S. PAT. OFF. & PRINCIPAL FOREIGN COUNTRIES

n at ee—Reducing Overhead-Increasing Production!!

raft ry, Intermediate

23. h or low carbon wire.
ocks to verage Operator.
—4 h 1400 lbs. per block.
—5 h 1100 lbs. per block.
f this roved model in operation

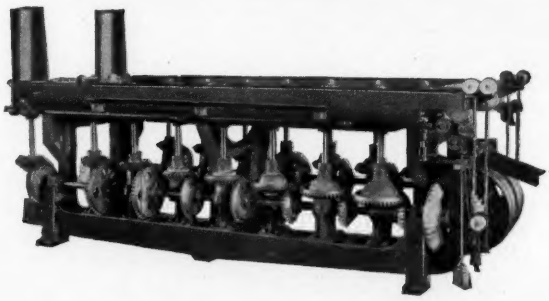


Double 8-Draft Fine Wire: Wet

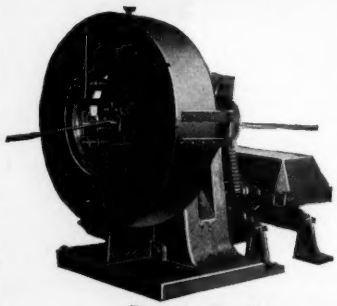
No. 22 to 36. High or low carbon wire.

6 Blocks to Average Operator, 22-33, 8-hole, 660 lbs. per day of ten hours.

Many thousands of these heads in operation



ARMORING MACHINES FOR



Patents Pending

"BX," PARK CABLE MOTOR WIRES, HOSE Etc., Etc.

High Productive Speeds

LOCK WASHER MACHINERY

with Enormous Output

HIGH SPEED STRANDING MACHINERY

t HARTLEY, Inc.

Agents: Philadelphia Territory
Swind Machinery Co.

ITALY—Henry Coe & Clerici, Milan. AUSTRALIA AND NEW ZEALAND—Edwin Wood Pty., Ltd., Melbourne.
JAPAN—Andrews & George Co., Tokyo. SWEDEN AND FINLAND—Akt., Rylander & Asplunds, Stockholm.

ER MASS., U. S. A.

Domestic Exports of Iron and Steel Wire, Wire Rope and Nails, From the United States, By Countries

July 1927

Countries	Plain iron or steel wire	Galvanized wire	Barbed wire	Wire rope	Insulated iron or steel wire and cable	Wire nails
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
Norway	.....	.....	.....	.....	.....	379
Rumania	.....	.....	.....	6,260	.....	.....
S. Russia in E.	890	.....	.....	10,250	.....	.....
Spain	.....	.....	.....	15,360	.....	.....
Sweden	100	.....	.....	.....	.....	.....
Switzerland	300	.....	.....	.....	.....	.....
Turkey in Europe	263	.....	.....	.....	.....	88
United King.	108,342	38,024	.....	.....	6,137	51,760
Canada	896,893	1,090,301	470,099	13,060	1,622	21,524
B. Honduras	.....	.....	2,500	1,580	.....	1,200
Costa Rica	17,097	.....	10,800	1,151	.....	2,838
Guatemala	.....	.....	50,500	7,568	.....	14,070
Honduras	.....	2,125	208,500	3,202	.....	50,051
Nicaragua	324	200	207,401	972	.....	76,071
Panama	4,148	8,615	96,650	113,031	4,099	85,036
Salvador	3,600	9,335	17,500	.....	.....	2,149
Mexico	469,608	201,337	1,301,618	52,010	3,978	27,258
Miquelon & St. Pierre Is.	.....	.....	.....	.....	.....	400
Newfoundland & Labrador	23,432	166	.....	.....	.....	3,745
Bermuda	2,645	60	.....	.....	.....	6,000
Barbados	.....	.....	.....	.....	.....	1,070
Jamaica	.....	.....	31,200	2,675	137	2,200
Trinidad & Tobago	.....	.....	.....	16,678	.....	.....
Other B. W. Ind.	2,020	.....	2,700	5,057	.....	11,460
Cuba	71,350	45,677	1,341,552	36,621	12,449	306,821
Dominican Rep.	25,572	20,936	184,518	8,445	.....	159,695
D. W. Ind.	970	60	.....	460	.....	1,525
F. W. Indies	.....	.....	2,000	.....	.....	.....
Haitian Republic	500	.....	14,895	240	.....	11,600
Virgin Is. of U. S.	525	.....	9,850	.....	.....	1,100
Argentina	2,457,767	850,282	2,236,764	44,246	.....	1,640
Bolivia	.....	.....	.....	31,884	.....	2,600
Brazil	141,204	.....	1,335,279	18,373	328	37
Colombia	17,066	51,260	558,250	5,497	.....	386,491
Chile	3,225	274	.....	120,122	2,850	.....
Ecuador	3,947	.....	86,000	1,893	845	300
B. Guiana	.....	.....	.....	.....	340	.....
Paraguay	.....	.....	.....	2,809	.....	441
Peru	200	69,522	.....	48,539	.....	255,338
Uruguay	5,174	54,563	.....	170	.....	1,433
Venezuela	1,060	13,701	116,650	11,532	44,968	35,897
B. India	.....	11,230	.....	5,198	.....	.....
B. Malaya	.....	.....	75,000	2,600	.....	.....
China	78,410	503,410	.....	1,010	.....	.....
Java & Madura	125	.....	235,980	.....	3,875	.....
Other D. E. Ind.	2,500	.....	118,673	11,055	.....	1,360
French Indo-China	.....	6,732	.....	.....	.....	.....
Hongkong	.....	.....	770	.....	.....	.....
Japan, Inc Chosen	51,670	.....	.....	15,372	1,800	92,000
Kwantung Leased Ter.	.....	.....	.....	.....	.....	40,000
Philippine Is.	234,272	49,450	1,929,073	93,800	.....	1,001,032
Australia	106,171	44,610	1,000	.....	.....	2,206
B. Oceania	.....	.....	.....	.....	.....	4,500
F. Oceania	.....	.....	.....	300	.....	1,253
N. Zealand	4,034	.....	.....	250	27	.....
B. S. Africa	182,504	156,000	417,725	.....	3,035	7,203
Portugese E. Africa	200	.....	133,076	.....	.....	.....
Canary Is.	.....	.....	.....	.....	.....	100
Austria	560	.....	.....	.....	.....	.....
Total Quantities	4,918,668	3,227,870	11,196,523	709,270	86,490	2,671,871
Total Values	170,631	86,620	328,045	90,790	15,651	90,427

Shipments from the United States to Non-Contiguous Territories.

	6083 Wire		6092 Wire Nails	
	Pounds	Dollars	Pounds	Dollars
Alaska	456,712	42,894	225,123	9,914
Hawaii	578,165	38,220	306,814	14,116
Porto Rico	236,732	14,123	58,780	2,481

DETAILS of the mechanics of cable structure and testing of cables and wire for strength are given by A. I. Tracey in the article Practical Points on Cable Manufacture. He goes into the mechanism of breakdowns from thermal, mechanical and chemical viewpoints, the two latter being of more than passing interest to the practical wire man. In addition, he discusses ionization and corona effects and a number of other more theoretical points. Stress calculations are given for three-cord super-tension cables. This is really a summary of Mr. Tracey's address to the National Association of Supervising Electricians, *London.—Elec. Times* (London), Dec. 1926.

Some Recent Literature on Wire and Cable

SHORTLY, we are to know all about the defects and methods of offsetting present disadvantages of welding wires, according to the reports and discussions before the American Welding Society and American Bureau of Welding, which met together in The Engineering Societies Bldg, New York, April 27-29, 1927. C. A. McCune, director of Research, Amer. Chain Co., outlined the research activities of the Page Steel & Wire Co., Bridgeport, a subsidiary of the Chain company, and told how welding wire forms the major portion of the investigations of fusion welding research. This research starts with the making and composition of the steel, follows through all the processes of rolling and drawing the wire, also all handling processes, in fact carries right through to the actual use of the wire in welding and the results obtained therein. Magnetic testing is being employed. Studies are being made of the effect of varying temperatures upon the efficiency of the welding wire and upon the resulting weld. In his report as Chairman of the welding wire specifications committee, Mr. McCune told how samples of welding wire are being collected and subjected to metallurgical, chemical and other examinations to determine why some of this welding wire now on the market is called "bad" by users. The results of this self-examination campaign can not help but prove very beneficial to all the cooperating manufacturers of welding wire.—*Iron Age*, May 5, 1927.

NEWS OF THE INDUSTRY

The Worcester Wire Works, Inc., Worcester, Mass., has awarded the contract for its one-story addition.

A controlling interest in the Habirshaw Cable & Wire Corp., New York, has been arranged for by the Eastern Wire & Cable Co., N. Y., a recently formed corporation. Operations in both the Yonkers and Bridgeport plants will continue.

The Maring Wire Co., Muskegan, Mich., has disposed of a bond issue of $250,000. A portion of this fund is to be used for expansion.

A recently organized wire company has arranged for the establishment of a plant at First & Linden Sts., Oakland, Cal. This company, under the name of the Button Wire Co., will specialize in the production of patented buttons used on wire for stucco wall constructions, and other kindred specialities. Factory branches are planned for San Francisco and Los Angeles.

Harry Williams Goddard, formerly president and treasurer of the Spencer Wire Co., Worcester, Mass., died at his home in Worcester. He was connected with the Washburn & Moer Mfg. Co., now the Worcester Works of the American Steel & Wire Co.

Mr. Goddard was formerly president of the Worcester Chamber of Commerce and was active in many lines.

The Cosgrave Wire Cloth Co., Inc., of Bellville, N. J., has organized the expansion of the wire weaving plant of M. P. Cosgrave. Wire cloth of the finer grades, particularly of monel and nickel has been the product of this plant, but the new company will be in a position to supply fine wire cloth from all metals suitable for weaving.

An option of a million and a half dollars has been given by the directors of the Belfont Steel & Wire Co. on its plant. This has been done with a view of reorganization of the concern, balancing of the books and continuation of operation on an enlarged scale. This option held by a representation of a New York banker and a Pennsylvania manufacturer expires Jan. 1, 1928.

The Hazard Wire Rope Co. of Wilkes-Barre, Pa., have taken over the wire rope department of the Hazard Mfg. Co. of the same city and will take care of all the business in that line.

British foreign trade in iron and steel wire during June and July, 1927

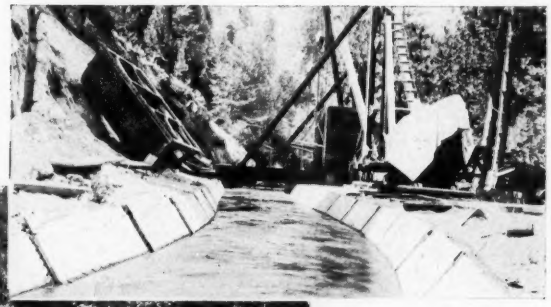
(In gross tons)

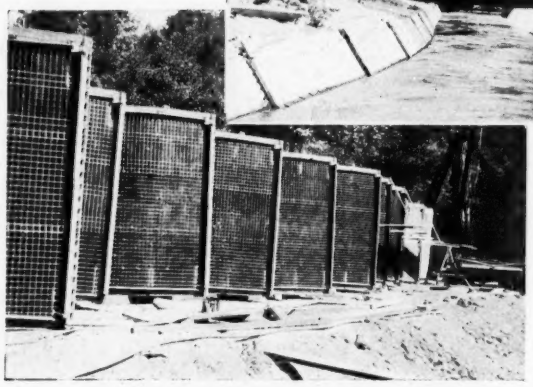
Item	Imports		Exports	
	June	July	June	July
Wire	4,763	5,362	5,831	5,503
Wire cables and rope	.....	.....	2,148	1,602
Wire nails, including staples	4,911	5,453	166	168
Wire manufactures, not elsewhere specified	764	737	684	1,003
Nails, tacks, rivets, and washers	845	751	1,443	1,230
Bolts and nuts, including screws for metals	1,102	1,057	2,172	1,954

Wire Mesh in Concrete Work

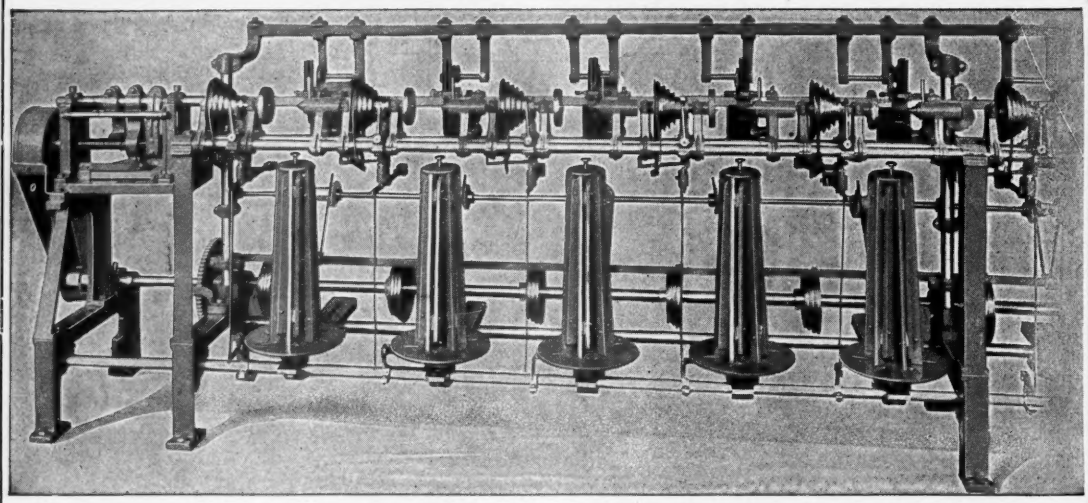
A POWER ditch operated by the Western States Gas & Electric Company was lined with precast concrete slabs which were reinforced by wire mesh as shown in photo No. 1. These precast slabs were placed in the ditch after it had been placed in operation, thus obviating the necessity of unwatering the canal. The slabs reinforced with the wire were made upon semicircular steel forms by the use of gunite machine and allowed to harden.

Photograph No. 1





Photograph No. 2



KOEGEL FINE WIRE SPOOLING MACHINE FOR SPOOLS UP TO 6" DIAMETER, STANDARD MACHINE FROM FOUR TO TWELVE HEADS. CAN FURNISH WITH ANY DESIRED NUMBER OF HEADS.

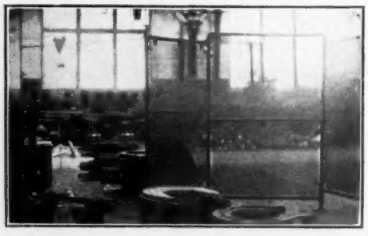
Above illustration shows our improved type of fine wire spooling machine. This machine has some very important features, for example, the head sections are so designed that no spool spindles are required, and this, we believe, is a very good time saver which all manufacturers will appreciate. Another feature is that the swifts or blades are located underneath the machine, and directly in front of the operator, thereby making it very convenient for the operator when filling the swifts or blades with bundles of wire. Write us for further details about this machine.

Wire Spooling and Winding Machines of Every Description

CHAS. KOEGEL'S SONS, INC.

Holyoke, Mass.

Wire Folding Screen Protects Workmen at Southern Pacific Shops



AT the Southern Pacific Shops in San Francisco a very effective method is employed in protecting workmen from flying chips as shown in the accompanying photo. This protection is provided by means of the home-made screen which consists of heavy wire screen fastened to a frame made of pipe. At the base of each pipe there is a large flange resting on the floor which keeps the screen from falling over. When a workman is chipping babbit from a bearing this screen is placed between the bearing and the other workmen as shown in the photo which stops all flying chips. This screen can be easily and quickly folded up and moved to any part of the shop.

British Wire Imports to Bear Mark of Origin

(*Continued from page 247*)

high on the surface of the label attached thereto in a prominent place.

The committee also expressed the opinion that chain link fencing should not be excluded from the order, and recommended that the order should take effect "on January 1, 1928, or three months after the making of the order, whichever date is the later."

It is considered unnecessary to restrict the use of certain

colors to avoid confusion with British labels, since any rights which the owner of a label may possess under the existing law to protection against imitation will remain unimpaired. The committee also considers it unnecessary to require a tin tally to be attached to each roll or bundle.

Invention for Wire-bound Boxes

(*Continued from page 346*)

its parts in the finished box definitely predetermined. This is accomplished by the assembly of cleats and sheets upon a workholder in relationship to each other determined by mechanical positioning devices, these relationships being perpetuated by binding wires and staples. Rosback and his associates propelled raw material strips through a blank machine to produce a rigid blank which had to be made foldable at a subsequent step by means of a stepmitering machine.

Plaintiff's expert states the comparison concisely as follows:

"The Rosback practices had taught the idea of producing foldable relationships by the operation of cutting the preliminary rigid blank. Inwood and Lavenberg rejected that teaching and solved their problem by relatively positioning and wiring together entirely separate parts in such manner that their intended cooperation in the finished box should be ensured. In brief, Rosback taught the production of foldable relationships by cutting. Inwood and Lavenberg produced a flexible box blank by an assembling and wiring together of separate elements."

The validity of the wire-bound box patent No. 12725 was sustained in the case of Wirebounds Patent Co. v. Chicago Mill and Lumber Co., 238 Fed. Rep. 929. This patent expired September 19, 1922, and the public has thereby acquired certain rights, the precise nature of which is an important element of this controversy. As a result of litigation and interference proceedings the two machine patents applied for in October, 1904, were not issued until February 9, 1915.

Complaint Alleges Three Species of Infringement

By original and two supplemental bills of complaint three species of infringement by defendant are alleged. The first species involves a blank machine and method in which the blank produced on the machine was made up of four side sheets and two pairs of cleats, the third and fourth pairs of cleats being added with the blank at a later stage in the method, this being denominated the alternate cleat method.

The second species of alleged infringement involves a machine and method whereby the blank machine receives four side sheets and four pairs of cleats, two pairs of cleats having been pretacked to their respective side sheets, this being called the precleated method.

The third species of infringement which is set forth in the second supplemental bill relates to a blank machine and method characterized by the use of four side sheets and four pairs of cleats, all of which are detached from each other when they are put on the blank machine. This method is referred to as the full cleated method. It is asserted that by this third species of alleged infringement defendant has adopted precisely the practice disclosed by the patents in suit, namely, the assembly of eight loose cleats and four loose side sheets upon a blank machine or workholder which is a mechanical device for positioning preformed and predimensioned box parts for cooperative foldable relationships so that binding wires may be stapled to the box parts to the end that all of the box parts are connected with wires which perpetuate the relationships in which the box parts are assembled.

The parties agree that there is no material difference between these three machines and methods excepting that by the practice of the third method defendant has drawn nearer to the patents in suit, machinery for practicing the third method being fundamentally and in principle the same as the machines previously complained of. It follows, therefore, that if the use of defendant's third machine and method does not constitute infringement neither do the first and second machines and methods.

Other Methods Not Commercially Practical

It seems to the court that plaintiffs' expert has correctly expressed the improvement of the Inwood and Lavenberg patents over the preceding Rosback inventions in the comparison hereinbefore quoted, namely, that Rosback taught the production of foldable relationships by cutting, while Inwood and Lavenberg taught the production of foldable relationships by assembling and wiring together separate box elements. The Inwood and Lavenberg method produced a box having the merits sought.

An important question here presented is whether the essential elements of that method of production are now open to public use by reason of the expiration of the box patent or whether by reason of the grant of the method patent nearly 10 years later plaintiff still has the right to enjoy for a considerable period the exclusive use of the method disclosed in the method patent. Careful consideration of the evidence results in the conclusion that neither the so-called modified Rosback method nor any other method suggested for producing the box are commercially practical though they may be theoretically possible.

First Method Claim Was Abandoned

The method patent in suit presents an anomalous history. Notwithstanding the fact that the specifications of the box patent fully disclosed the essential difference between the prior

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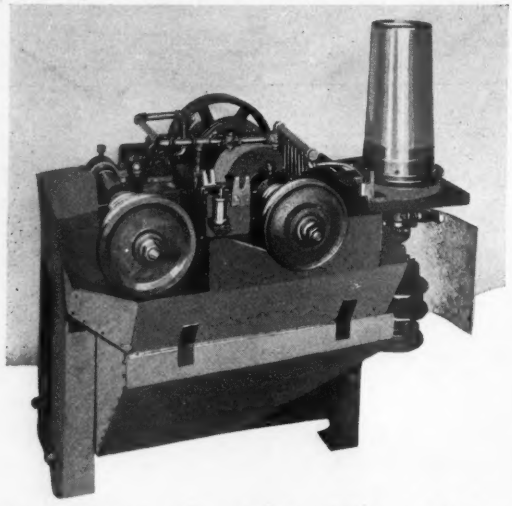
Superior Wire Drawing Machine

An 8 draft continuous machine for copper or steel wire.
Clutch action on spindel and main drive.
All gears are enclosed in an oil tight case.
Ball bearings throughout.



Designers and Builders of Wire Drawing and Special Machinery

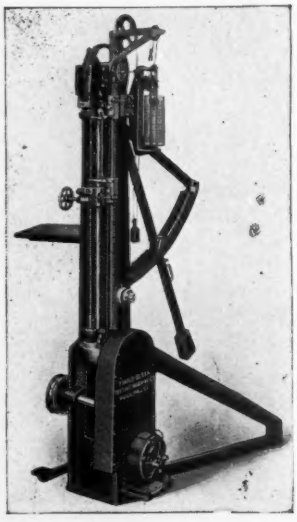
The Superior Tool & Mfg. Co.

172 Union St. Worcester, Mass.

Olsen Vertical Autographic Pendulum Type

WIRE TESTER

Made in capacities from 50 lbs. to 1000 lbs.



This illustration is of the very latest up-to-date Autographic Wire Tester which will scribe the stress strain diagram on square cross-section paper, correcting for the sine angle of the pendulum to magnify the elongation of the wire ten times. The autographic record may be taken directly from the wire, and thus the greatest of accuracy secured in such a record, as we do not consider any autographic record or wire test as satisfactory or acceptable taken from the motion of the heads of the testing machine.

Olsen Autographic Wire Testers can also be secured of capacities from 10,000 lbs. up to 1,000,000 lbs. capacity for testing steel, copper or brass wire of all gauges, as well as the largest wire rope made.

Also manufacturers of Olsen Static-Dynamic Balancing Machine equipment for balancing high speed rotating parts, which will eliminate vibration and increase efficiency and production of all high speed machinery.

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methods and the method by which the box could be produced, no claims were at any time made in connection therewith which would indicate to the public that applicants believed the method to be patentable. It is true that on November 2, 1904, Inwood and Lavenberg filed method claims in the stapling machine application.

On December 31, 1904, however, the Patent Office objected to the amendment and in so doing used the following language:

"The proposed amendment filed Nov. 2, 1904 has not been entered. There is no foundation for method claims in this case. Moreover, this amendment cannot be entered unless accompanied by a supplemental oath, and the amendment is refused admission for that reason. It is to be noted, however, that the alleged method claims are not believed to cover proper methods, but merely the operation of the machine covered by the other claims in the case, so that even if this amendment were supported by a supplemental oath and entered the method claims contained therein would be subject to rejection."

On January 16, 1905, the Commissioner of Patents was instructed by the attorneys for applicants to cancel the proposed amendment. This was clearly an abandonment of the method claims. No method claim was again filed until March 30, 1912. This claim was required by the examiner to be erased because directed to divisional subject matter. Method claims were again filed April 8, 1913, and again required to be erased for the same reason.

The claims for method patent were not again filed until March 14, 1914, at which time they were filed as an amendment to the workholder application, whereupon it was directed by the examiner that the claim must be presented in a separate application because directed to divisional subject matter. This resulted in the application for method patent filed April 21, 1914, upon which the method patent in suit was issued. At

the time this application was filed the method disclosed by the box patent had been in use for considerably over nine years.

Careful consideration of the testimony in this case discloses no sufficient reason why Inwood and Lavenberg should not have filed their divisional application long before the date upon which it was actually filed. It appears from the evidence that the interference in which the two machine patents were involved had nothing whatever to do with the method or process. There being no evidence of inadvertence, accident or mistake, it seems to the court that the long delay of Inwood and Lavenberg in filing the divisional application constitutes laches invalidating the patent issued thereon. No special circumstances sufficient to explain the delay have been established. See Webster Electric Co., v. Splitdorf Electric Co., 264 U. S. 463; Victor Talking Machine Co. v. Brunswick-Balke-Collender Co. et al., 290 Fed. Rep. 565, 8 Fed. (2) 41.

In this case, therefore, the product patent having expired, the public has become entitled to produce the box by the method disclosed by the patent. As previously stated the reissue box patent expired September 19, 1922, and on that date the defendant and the public had the right to begin making and using the box blank and the method of manufacture thereof disclosed by this patent.

It appears to the court that as soon as the method disclosed in the box patent was divulged, it became obvious to those familiar with the prior Rosback inventions that in order to produce the Inwood and Lavenberg box blank it would be necessary only to add the extra pushers called for by the extra pieces of a different form of blank, and that so to do was a matter merely of the exercise of ordinary mechanical skill.

The machine used by defendant is nothing more than the Rosback machine with additional pushers placed on the feed chains. Consequently, there is

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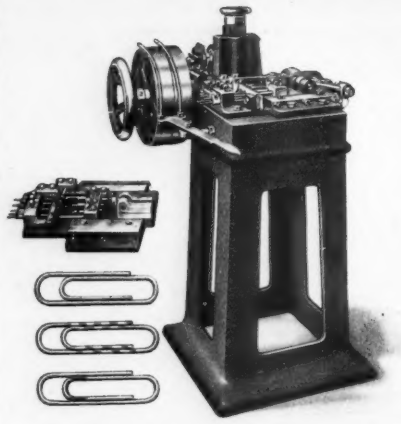

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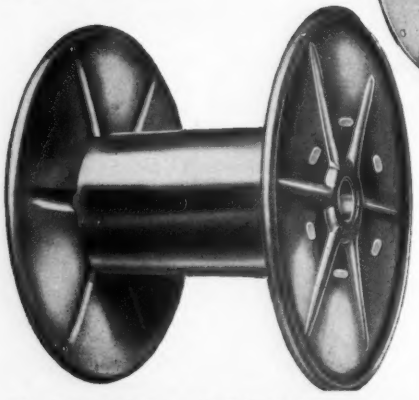

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101 Augusta St., GREENVILLE, S. C.

no infringement of the method patent nor of the machine or workholder patents. A decree will therefore be entered dismissing the bill of complaint.

July 9, 1927.

The equipment of the Hamilton, Ont., plant of the Canadian Steel & Wire Co., a subsidiary of the U. S. Steel Corp., will be installed at the Ojibway plant. This equipment will be for drawing and galvanizing wire of various sizes.

Among the firms exhibiting at the New England Fair which opened Sept. 27 and will close at midnight, October 1, were: American Steel & Wire Co., Morgan Construction Co., Parker Wire Goods Co., and the Geo. F. Wright Steel & Wire Co.

Drawing of Round Wire

(*Continued from page 344*)

sufficient just to enable the operator to attach the end to the vise at the top of the block with possibly a half turn round the drum, hence the necessity for a fairly strong vise to hold the end. Before throwing the block into gear, the wiredrawer must see that nothing will interfere with the free running of his coil from the swift and that it passes through sufficient lubricant on its way to the die. Many operators also give the wire a slight pull backwards before starting so that the block is completely in gear before the actual reduction in area commences. The block is then lowered slightly by means of a treadle, so that jaws on its lower edge are engaged by jaws attached to the constantly revolving spindle and the drawing operation starts.

While there are many different types of drawing machinery, the more important of which will be described later, the essential features will perhaps be best illustrated by means of the outline drawing Fig. 1.

This machine consists of the bend or frame A on which is mounted the die holder B. The point end of the wire being

passed through the die is gripped by the jaws C, operated by the chain drive D. The block E is driven from the line shaft F through the bevel gear G and rotating spindle H, the whole being brought into gear through the friction clutch J operated by treadle and links K and L.

The general type of block is the vertical spindle. These are, as a rule built in benches, there being anything from 6 to 30 blocks in a bench, frequently arranged in staggered formation in the centre of the shop so that operators work alternately at each side of the bench. When a larger number than 30 are employed it is usual to break the line shaft. As the distance between each block varies from 4 to 8 feet, it will be seen that a considerable length of shafting would be employed in a bench of 30 blocks. A portion of such a bench is illustrated in Fig. 2.

Many devices have been introduced by way of improvements in detail, particularly with regard to the method of bringing the block into gear. One such device is a friction clutch by means of which the block can be put in motion without altering its level.

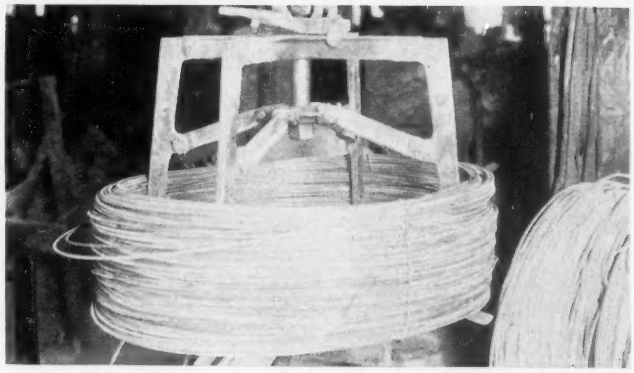
The largest size of block is usually 30" diameter and is called a "ripping" block, presumably so called because it is used for roughing down the hot-rolled rods prior to heat-treatment, i. e., letting them "rip" a pass or two without troubling to anneal or normalize the steel.

The next size of block is 26" diameter or thereabout, and so the sizes go down by about 2" at a time to 16" blocks. Smaller than this the blocks are usually called "jigger" blocks, and are used for drawing the smaller sizes of wire. An illustration is shown of a bench of "jigger" blocks. (Fig. 3.)

These "jigger" blocks do not require any wheel pit as the large blocks do.

The above are known as "single-holing machines."

In recent years there has been



Prevents rusting of wire between operations

OIL is a good rust preventive. But to slush every coil of wire between operations with it is needlessly expensive. Oil is costly, and it must be cleaned off the wire before subsequent operations.

But there is another way of preventing rust between operations which is both effective and economical. This is the Oakite way. One large company finds an Oakite solution ideal for anti-rusting a soft basic wire after pickling. So effective is the method that wire is wet drawn practically without rejections.

Low cost anti-rust is only one of many Oakite benefits. Call in a Service Man and have him give you full information about these modern materials and methods for cleaning and related operations in wire mills. No obligation.

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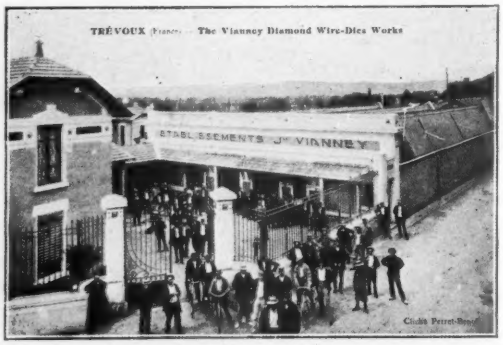

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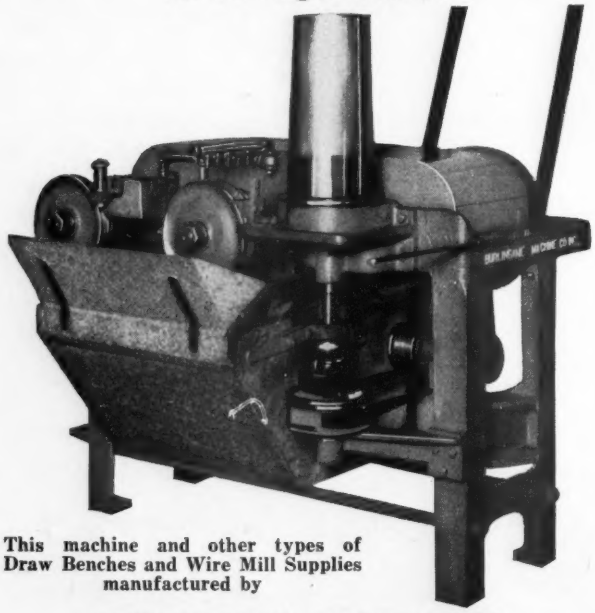
6 Draft **Liquor Finish**

For Drawing Fine Wire



This machine and other types of Draw Benches and Wire Mill Supplies manufactured by

BURLINGAME MACHINE CO.

149 COMMERCIAL ST., WORCESTER, MASS.

a tendency to draw wire continuously. The simplest form of continuous wire-drawing which has been in operation for the last thirty years on hard steel wire, is where one block is superimposed upon another—as per illustration. (Fig. 4.)

This, of course, will draw two holes only at one time. Another method of doing this is to have blocks side by side, as shown on photograph, the speeds being arranged according to the elongation of the wire. (Fig. 5.)

Recently there has been put on the market blocks with differential gear attached to the spindle which enables one to draw several sizes at one time. These differential blocks are usually mounted on one spindle.

The machine designed by Messrs. Barron & Crowther of Preston on this principle is illustrated both without wire and threaded up with wire. Two different sizes have been illustrated, and this method has considerably increased the output of wire per attendant. (See Figs. 6 and 7).

It is claimed that continuous wire-drawing is better owing to the fact that the wire being warm is in a better condition for drawing the second and third hole, especially in high-grade rope wire and higher carbon wires. More obvious advantages are, of course, the saving of time, labor and space.

It can be readily understood with this continuous wire-drawing that the difficulty which had to be overcome was the elongation consequent on the reduction of area of the wire, and in a simpler form this was allowed for by either running the drums quicker, or using larger diameter drums in proportion to the reduction of area of the wire.

It is obvious that a fixed drive, with fixed ratio of gearing, or fixed diameter of drum, only allows of drafts which can accommodate themselves to these fixed gears or diameters, but with a differential gear a variety of draftings can be accomplished on the same machine, the elongation of the wire automatically

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being taken up by the relative motion inside the block.

The three drums are mounted on a vertical spindle which has a positive drive, but these are connected with the differential gear and run loose on the spindle. The sizes are graduated so that the pull is divided equally between the wire, and so the speed of each block is advanced or retarded.

Messrs. Oslund Machine Company of Worcester have made a continuous wire-drawing machine on similar principles to the differential gearing but in a bench. The arrangement of the differential drive leading up to the bevel gears which drive the blocks, is novel as far as wire-drawing machines are concerned, each block being driven through differential gearing from the main driving shaft, thus compensating for the elongation on the wire as it is drawn through the dies. An illustration is shown of a bench of 4 blocks as made by this firm. (Fig. 8.)

Another continuous wire-drawing machine is one in which all the drums are of the same diameter set on horizontal spindles—as per photograph Fig. 9. These machines are, however, mostly used for softer non-ferrous wires, which do not come under consideration in this work.

Hitherto continuous wire-drawing machines have been designed on a principle somewhat analogous to that of the continuous rod rolling mills where each successive pair of rolls is speeded exactly to compensate for reductions. There is, however, another type of rod rolling mill in which the increased length of the rod after each pass is not taken up by increasing the speed of the rolls but by allowing the rod to form a loop between each pass. This is possible in rolling because the reducing and forwarding is performed by the rolls. In wire-drawing, on the other hand, the die reduces but the "block" or capstan puts the tension on the wire as it leaves each die and this makes it impossible to maintain a loop.

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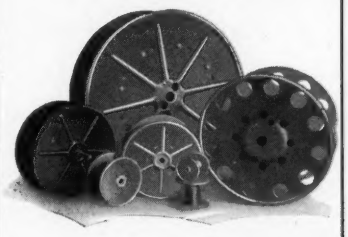

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There is, however, a continuous machine recently put on the market, viz., the Morgan-Connor wire machine which is the exact analogue of the looping mill, with all its simplicity and flexibility, and promises to be one of the most interesting developments in this art in many years. The machine has been described by Mr. Kenneth B. Lewis in the July and Aug. 1926 issues of WIRE & WIRE PRODUCTS.

There are various other kinds of wiredrawing blocks used, but they are all more or less on the principles of the illustration shown.

In addition to these machines, there are horizontal or bull blocks used for drawing rods 1 inch to ½ inch diameter. These blocks are enerally built double, that is to say there are two actual wiredrawing blocks working on the one machine. Many wiremills have not any of these large size blocks, because they are dealing entirely with hot-rolled rods below ½ inch diameter and in these sizes it is not necessary to employ a bull block. Trouble is sometimes experienced in drawing these very large sizes round a block as there is a tendency for the cross-section to be slightly distorted into elliptical shapes.

This is due to the fact that the material is being coiled on a comparatively small diameter and this trouble is especially likely to happen with low carbon steel when being drawn, as this material is softer. This has been compensated in a number of cases in the shape of the die. There is, however, a very wide difference of opinion as to the size of material that can be satisfactorily drawn on a drum which is rotating. If the material is very soft the elliptical shape, can be, to a certain extent, corrected by running the material several times through a reeling machine.

Wire and bars are also drawn on benches where the material is drawn out in straight lengths. These are mostly used in drawing large sizes from ½-inch to 3-inch diameter and also for the drawing of special sections

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which cannot, owing to their profile, be wound round a drum. An illustration is shown of an ordinary draw bench. Sometimes these draw 2, 3 and 4 rods at a time, in which case there are four dies and four gripping tongs but such machines are used only in drawing shafting and similar qualities of material.

(*To be continued next issue*)

British Insulated Wire Company's Works

(*Continued from page 337*)

tons capacity respectively. Insulating is also effected in other rooms, one of which is chiefly devoted to stranding. These departments, with the two long lead rooms and the general office block, occupy the southeast corner of the works. The impregnating plant is part of the equipment of the lead rooms, thus enabling the lead covering to be applied directly the cables leave the ovens, and cranes are provided for the quick transportation of the cables, the larger room being spanned by a 15-ton and a 10-ton crane, and the small room by a 15-ton and 5-ton crane.

When ready for lead covering, the cables are suspended (on the factory drums) in oil tanks. They are then unwound and passed through the lead-covering machines. These are of the usual type, in which the moulds receive the molten lead from overhead furnaces and apply it to the cable running horizontally through the centers. It might be more accurate to say that the lead is formed round the cable as, of course, any consideration of forcing the lead onto the cable is out of the question. Unless an alloy sheath is specified, pure virgin lead is used for the sheathing.

After testing the cable, if it is to be armored, it is taken to the armoring shop. This is a large room, 520 feet long by 100 feet wide, near the west extremity of the existing works, covered by a 15-foot crane. Two types of machine are installed, those for wire armoring and those for tape armoring. The former are similar in design to those employed for core stranding, and

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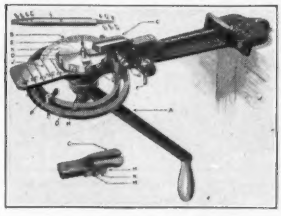

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the latter operate on similar lines to the paper covering machines. Two heavy machines arranged along the center of the department are the outstanding feature. The lead is compounded at one end of the machine and the cable is finally whitewashed at the other extremity, the covering of jute, cotton or hessian tape, etc., over the lead, the laying on of the armoring and the final jute covering being done in order along the machine.

On these machines and on smaller ones the entire operation in connection with the armoring of the cables is carried out. Welding machines serve a very useful purpose in this branch of the works for joining the lengths of wire and tape used for armoring. The railway track runs past the south end of this building, and across the lines is the drum yard, from whence the drums are transported to a distributing field on the opposite side of the by-road. A 5-ton "Goliath" crane, which runs on wheels 80 feet apart and has an effective span of 100 feet, serves the yard and field. It is electrically driven, the supply being collected from overhead wires run out on wooden poles. This crane is a recent addition, and its usefulness can be gauged by the large distributing area over which it operates.

All finished cables are dealt with in a fully-equipped cable-testing department adjacent to the armoring shop. This building, 260 feet by 100 feet, is served by a 15-ton crane, and is provided with three large immersion tanks. Three testing bays for pressure testing are arranged on one side of the test house and a gallery above the bays is equipped with the necessary measuring apparatus. Each bay is used and equipped for testing up to a given pressure, the maximum pressures being 10,000, 50,000 and 200,000 volts. The bay for the last named is also used for h. p. experimental work. Included in the testing plant are two Mordey-Victoria 2,000 v. alternators, relics of the original Prescot lighting scheme, still rendering good service. A 600-k. v. a. G. E. C. machine supplies the pressure-raising transformers at 1,000 v. For applying some of the lower pressures, an adjustable double coil is used in which the pressure is raised by balancing inductance against the capacitance of the circuit. All pressure tests are applied for at least fifteen minutes.

The manufacture of telephone cables is carried out in its entirety as a separate branch in two buildings to the south of the works, one being 400 feet long by 100 feet wide, and the other about two-thirds of this size. The former is served by a 5-ton crane, and deals with the manufacture up to the lead covering process, which is carried out in the smaller house, also equipped for testing cables. Two cranes —10-ton and 7-ton—span this shop. Paper-lapping machines for covering the bare copper strands are of the revolving-bobbin type. The twinning of the paper wound strands is carried out on horizontal and vertical machines. For multiple cables the process is carried out on special precision twinning machines designed to ensure that the lengths being twinned are exactly equal in order to obtain the balance of capacities vital in telephone work. A most interesting feature of this department is a long cabling machine which will build up 165 pairs of wires in one operation. This machine is of the revolving bobbin type and is made up of 10 fliers, each of which deals with one layer of wires or pairs of wires, each successive flier holding the larger number of bobbins required for the increased size of the concentric layer. Several machines of this type are installed in the department, and cables built up to certain sizes on some of the machines are transferred to others to be further increased. Telephone cables consisting of 1,350 pairs of wires have been built on these machines. Each wire is insulated by a spiral wrapping of paper, two such wires are then stranded together to form a pair, and finally two pairs are

(*Continued on page 369*)

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Advantages

ELMARID Dies, on certain sizes, are more efficient than Diamond Dies and Chilled Iron Dies. They can be easily re-cut to a perfect round size, allowing the wire mills to have this work done within their own plant and by unskilled workmen.

ELMARID Dies do not break, if the general rules for drawing wire are observed, and can be re-sized to a great extent. Since we have introduced these dies to the American Wire Mills, a great number of dies have already drawn more than a million pounds of wire. If they do draw off size, they maintain a round bearing.

In comparison with Chilled Iron Dies, they will save considerable labor expenses. This has already been experienced and acknowledged by a number of wire mills. Moreover, the speed of the wire drawing machines can be increased to a certain extent, thus enabling the wire mills to obtain a higher efficiency from their wire drawing equipment. Copper, Brass and especially Phosphor Bronze rods can be successfully drawn at the following elongation:

1st die: 50%	3rd die: 35%	following dies
2nd die: 40%	4th die: 30%	B & S gauge

Extraordinary good drawing results are generally obtained on Brass, Iron, Gold, White Gold, Bessemer Steel and High Carbon Steel on sizes from .020″ and larger. On Copper, the efficiency line may be drawn at the size of .051″ and larger. ELMARID Dies have also been used on Vanadium Steel and High Carbon Steel rods with satisfactory results in all respects.

E L M A R I D D I E S

Production Obtained:

When drawing through ELMARID Dies the following production is generally obtained:

Size	Kind of Metal	Production
.020″	Low brass wire	3 to 6 months
.040″ to .200″	" " "	continuous operation
.051″	Copper	50,000 lbs.
.064″	"	80,000 "
.114″	"	140,000 "
.162″ to .250″	"	250,000 " and more
.028″ to .064″	Bessemer Steel " "	35,000 lbs. to 80,000 lbs.
.025″	High Carbon Steel	8,000 lbs.
.072″	Iron	100,000 lbs.

This production can be considerably increased by practicing the methods described below.

Lubricant:

A wet and rather fatty lubricant should be selected. Where lime or soap powder must be used, it is essential that this is ground to a high degree, in order to avoid coarse particles from being carried with the wire into the dies which may cause scratches on the surface of the wire and which may cause the dies to become rough within an unreasonable period.

Solutions saturated with Alum have also produced good results in the drawing of Iron Wire.

Cooling

Wherever it is possible, the dies should be well cooled by either the lubricant or by a special device.

Cleaning

The dies, while in operation, should be inspected every two weeks, and metal particles be removed by washing and brushing the bearing with benzole. Rings which should appear in the front cone should be polished out.

Repair Works

The costs of keeping ELMARID Dies in good shape are very low and represent only a fraction of the costs of repairing Diamond and Chilled Iron Dies.

If a die shows rings in the front cone, these may be cut out by placing the dies on a lathe and by working out the front cone by the means of a pointed piece of hard wood, to which a little very fine diamond dust must be applied. The point of the wood should be shaped to just fit the front cone only. The same method may be employed if dies should show rough spots in their cones.

When ELMARID Dies become badly worn, or after they have drawn out of size, they can be re-sized in the same manner as Diamond Dies.

For the rough work a pointed steel needle applied with very little coarse powder performs rapid work. For finishing the last .0003″, a pointed piece of hard wood, applied with a little of very fine diamond dust should be used. This method will furnish the bearing of the dies with a mirror like polish. The Diamond powder should be mixed with Castor oil.

In order to keep the expenses for repair works to a minimum, we have designed a polishing machine of special make which can be easily operated in any wire mill by unskilled workmen. However, where not more than 15 dies are in use, it will not pay to put up one of these machines and we are prepared to undertake any work that may be required at very low rates.

(*Continued from page 364*)

stranded together to form a quad. Each quad is held together by an open wrapping of paper tape, and then the whole of them are stranded together to form a complete cable. This is wrapped with paper and finally covered with a lead sheathing as already described for power cables. By the use of different colored paper, the various aires of a quad are readily distinguished from each other. For insulation test, the corresponding wires of all quads are connected together, and each group tested with a pressure between the other groups and earth.

The braiding of aerial cable is effected on 24-bobbin machines. It will be seen from the photograph of the braiding room that the cables are unwound and rewound, before and after braiding, on drums under the platform on which the machines are mounted. Special cables for hot climates are dealt with on these machines. The cotton covering shop is located adjacent to the braiding department, and is equipped with cotton-whipping machines of several types, including some of the high-speed central bobbin type. The production of enameled wire is carried out extensively, and it is worthy of mention that over 300,000 miles of this material were sold last year in sizes up to .048-inch diameter.

The accessories department of the undertaking is by no means a small branch. It occupies some 14 acres at the northeast corner of the works. It is a factory within a factory, and employs something like 1,200 hands. Electrical equipment of every description is manufactured. Two large foundries form a considerable part of this department, and turn out castings for the various products. The machine shop is of particular interest. Here electrical welders are made for butt, seam and spot welding in many varieties. The firm has been making electric welders on the contact-resistance system for the last 25 years, and at present is turning out over 80 different types.

Almost every type of insulated and uninsulated copper conductor is manufactured at these works. Cotton covered, braided and enamelled wires, fittings for overhead equipment of electric railways and street-car systems, boxes, pillars, fuse boxes, house service meters and fans and a host of other articles are manufactured.

A fleet of 21 electric battery trucks is engaged on transportation duties in and between the various shops and departments throughout the works. These are mostly of the elevating-platform type, and are each of two-tons capacity. The batteries for these vehicles are charged at a special station capable of dealing with fifteen trucks at a time. An electric one-ton runway serves all the shops of the wire mill department, except the extruding room.

Practically the whole of the machinery throughout the works is electrically driven, and the supply is received from the company's own 5,500 kw. capacity generating station, located on the site, supplemented by a supply in bulk from the Liverpool Corporation. The demand of the factory is in the neighborhood of 9,000 h. p., but the station also supplies the town of Prescot. The generation is three-phase a.c., but most of the factory is equipped with d.c. motors, the necessary conversion being done in a rotary station put down by the company. The general offices face the railway at the front of the works and occupy some 25,000 square feet floor area. The departmental offices are arranged on the sites of the departments.

Transverse Testing Apparatus

(*Continued from page 345*)

ed, but it is then necessary to divide the value obtained by the sine of 45 degrees, that is by 0.707, in order to obtain the amount of deflection.

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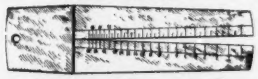

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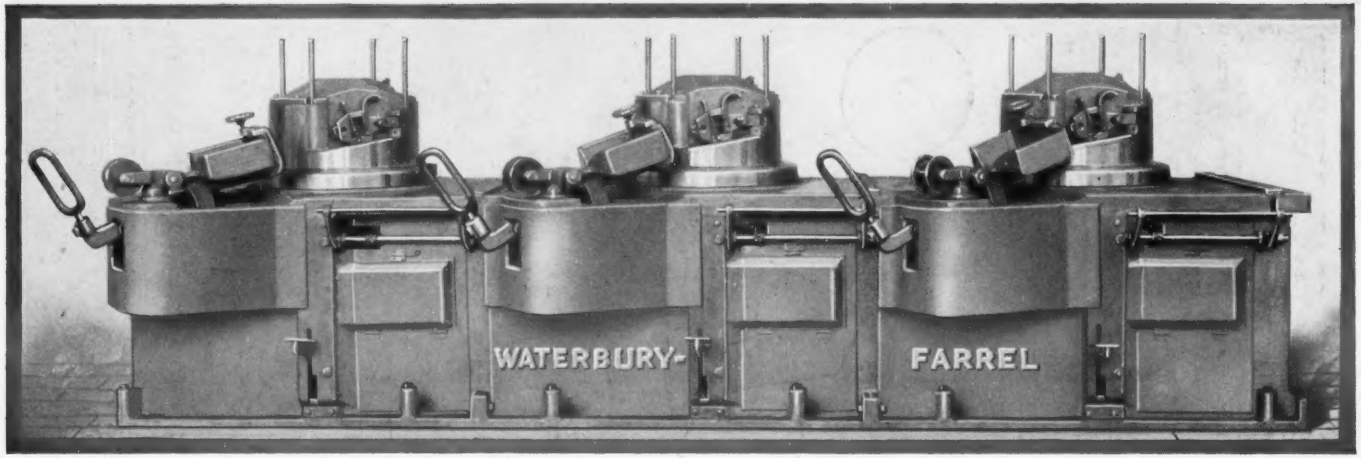

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